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OBLITERATIVE FRONTAL SINUSITIS

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PHILADELPHIA

The partial or complete obliteration of the frontal sinus cavity by osteogenesis is, I believe, a hitherto undescribed complication of chronic disease of the frontal sinus.

A chronic infection of the mucosa may spread into the bony walls of the sinus and terminate in osteomyelitis, or osteogenesis, if I may use the latter term to indicate a disease rather than an entity. In osteomyelitis, which is a destructive osteitis, the tissues are overwhelmed and destroyed by the invading organisms, as so notably described by Wilensky,[1] Dan McKenzie,[2] Furstenberg,[3] Mosher[4] and others,[5] whereas in osteogenesis, which is a proliferative osteitis, the tissues become proligerous to wall off or encapsulate the infecting organisms.

Read at the annual meeting of the American Laryngological Association, Toronto, Canada, May 30, 1935.

1. Wilensky, A. O.: Osteomyelitis, New York, The Macmillan Company, 1934; Osteomyelitis of the Skull, Am. J. Roentgenol. **16**:123, 1929; The Mechanism of Bacterial Infection, Arch. Surg. **13**:228 (Aug.) 1926; Osteomyelitis of the Skull, ibid. **27**:83 (July) 1933.

2. McKenzie, Dan: Osteomyelitis of the Frontal Bone, J. Laryng. & Otol. **28**:6, 1913; Further Observations on Spreading Osteomyelitis of the Skull, ibid. **42**:293, 1927.

3. Furstenberg, A. C.: Osteomyelitis of the Skull: Osteogenetic Processes in the Repair of Cranial Defects, Ann Otol., Rhin. & Laryng. **40**:996, 1931; The Pathology of the Spread of Osteomyelitis of the Skull, Tr. Am. Laryng., Rhin. & Otol. Soc. **39**:423, 1933.

4. Mosher, Harris P., and Judd, Delbert K.: An Analysis of Seven Cases of Osteomyelitis of the Frontal Bone Complicating Frontal Sinusitis, Laryngoscope **43**:153, 1933.

5. Dixon, O. J.: Diffuse Cranial Osteomyelitis Complicating Frontal Sinusitis, Ann. Otol. Rhin. & Laryng. **43**:16, 1934. Hastings, H.: Acute Fulminating Osteomyelitis of the Frontal Bone, Arch. Otolaryng. **6**:559 (Dec.) 1927. Myers, G.: Osteomyelitis of the Skull, J. A. M. A. **95**:406 (Aug. 9) 1930. Bulson, A. E.: Osteomyelitis of the Frontal Bone Complicating Frontal Sinus Disease, Tr. Am. Acad. Ophth. **30**:102, 1925. Dabney, V.: Osteomyelitis of the Frontal Bone, Arch. Otolaryng. **8**:177 (Aug.) 1928. Woodward, F. D.: Osteomyelitis of the Skull, J. A. M. A. **95**:927 (Sept. 27) 1930.

Jonathan Wright stated:[6]

So far as the bone changes are concerned, the pathological condition is directly related to the normal processes of bone growth in the nose, in its origin, and throughout its whole course. This relationship is not difficult to recognize. I have become accustomed to look upon this sort of inflammation as due to the substitution of the stimulus of irritation, whether from external surface agents, from bacterial agents of disease within the surface, or from systemic vasomotor disorders, for that mysterious physiological stimulus of growth which carries with it some agency which shapes the symmetry of form.

In pathological processes that agent, which shapes the symmetry of form, is absent or works badly and we get unsymmetrical development in the hyperplastic irregular forms.

He added "that the new bone growth starts as a sequence of an ordinary hyperplasia of the mucous membrane."

It is therefore the product of the infection within the hyperplastic membrane lining the sinus cavity that forms the stimulus of irritation to the granulations in the diploic spaces. These, according to Furstenberg, are converted into fibrous connective tissue, which may be followed by the development of a dense layer of compact bone.

The periosteum beneath the infected lining membrane may be so traumatized by the disease that it becomes congested and thickened and assumes the appearance of granulation tissue. The latter serves as a young connective tissue base of an embryonic character in which ossification may follow. There is a rapid multiplication of the connective tissue elements, with a differentiation of some of the cells into osteoblasts. Thus there is formed an interlacing framework of trabeculae, which is at first uncalcified and is spoken of as osteoid tissue. This later is infiltrated with the calcium salts to complete the process of ossification. Such changes constitute a most effective protective mechanism on the part of nature to imprison the infection and prevent its invasion of the diploe and calvarium.

The following description is taken from Dr. Case's report of the laboratory examinations in case 1, which is reported later:

The examination of the bone removed from the frontal region of Mrs. L. L. shows very dense bone the marrow spaces of which are filled with fibrous tissue.

In places layers of osteoblasts are seen lining the trabeculae, indicating new bone formation. Apparently this new bone formation is a rather slow process.

No bone necrosis was encountered.

One of the lantern slides shows the dense character of this bone and the other an area of new bone formation.

My conception of the different reactions of the frontal bone to a chronic infection of the mucous membrane within the sinus is based on: (1) the histogenesis of the frontal plate of the sinuses, (2) the virulence of the invading organism, (3) the resistance of a person to the infection and (4) traumatism to the bone (external or operative).

6. Wright, Jonathan, in Sluder, Greenfield: Headaches and Eye Disorders of Nasal Origin, St. Louis, C. V. Mosby Company, 1918.

The study of the frontal sinuses shows, in the great majority of instances, that the sinus is surrounded by compact bone. Occasionally this layer of compact bone is very thin. In such conditions, infection from the mucosa of the sinus may readily gain entrance to the diploe. With this thought in mind, I shall consider the structural difference between the compact bone, with its ability to wall off the infection, and the cancellous bone, with its aptitude for dissemination of the infection.

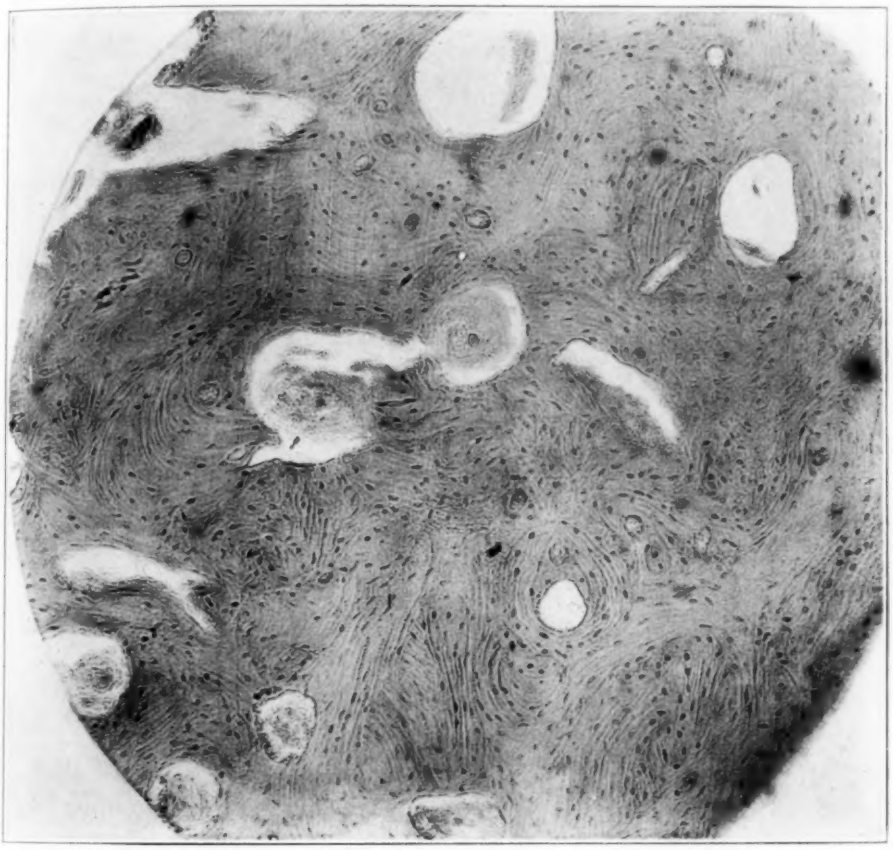

Fig. 1.—A photomicrograph showing the dense character of the bone.

The dense or compact bone lining the sinus and also forming the outer shell of the frontal bone consists of superimposed layers of calcified connective tissue, called lamellae, surrounding a central channel, termed a haversian canal.

For a review of bone construction the following quotation from Virchow is presented:

> Between these lamellae, and arranged concentrically around the central canal, are a number of minute spaces (lacunae). These lacunae are connected with

each other, and with the central haversian canal, by a number of fine channels (canaliculi) radiating like the spokes of a wheel. Between these units, and filling in the irregular intervals between them, are other lamellae, with their lacunae and canaliculi, running in various directions. These are termed the interstitial lamellae. Still other lamellae are found on the surface of the bone, which are called circumferential or primary lamellae to distinguish them from the special lamellae around the axis of the haversian canals.

Fig. 2.—A photomicrograph showing the new bone formation.

The haversian canals, which average one-five hundredth inch in diameter, contain two blood vessels, some nerve fibers, lymphatic vessels and spaces, and a minute amount of connective tissue.

The lacunae are occupied by a branching cell, termed a bone cell, the processes of which pass through the adjoining canaliculi. These bone cells are flattened, nucleated cells, and are homologous with connective tissue cells.

Between the very thin periosteum lining the sinus cavity and its surface cortical bone there is found a layer of scattered cells, which

are designated as osteoblasts and are important for the growth and repair of bone.

Protected by the covering of compact bone, with its microscopic channels, is the cancellous bone, or diploe, so called for its structure of thin plates surrounding large tortuous vascular canals. When this bony structure is divided, the vessels do not collapse in the canals but remain patulous. If infection gains entrance to these wide-open venous channels, their construction tends to promote and facilitate the spreading of a progressive continuation of the infection by a thrombotic process.

It is my opinion that the likelihood of osteomyelitis occurring in chronic diseases of the frontal sinus depends on the thickness of the compact bone separating the infection from the diploe.

If the compact bone is of adequate thickness to withhold the invading organism from the diploe and the person's resistance is capable of responding to the bacterial stimulus (by an excitation of the osteoblasts), there is an additional protection by the growth of new bone. Once started, this growth may continue until the sinus cavity is obliterated by the apposition of the walls of the sinus.

That osteomyelitis may follow such minor intranasal operations as the enlargement of the frontal ostium, or even the removal of a frontoethmoid polyp, is a recognized fact, but I do not believe that osteanagenesis has ever been described as a complication of disease of the frontal sinus following intranasal instrumentation.

I believe that if the cancellous bone is exposed to the infecting organism osteomyelitis may develop, whereas if the compact bone is exposed and the traumatism is slight nature responds by the stimulation of a growth of new bone.

The statement is erroneous that the thickness of the anterior plate of the frontal sinus is dependent on the quantity of cancellous bone separating the two layers of compact bone. I shall present a picture of a relatively thin frontal plate, with a preponderance of cancellous bone, and another picture of a relatively thick wall of pure compact bone. There are two specimens which show failure of development of the frontal sinus. One is chiefly cancellous bone and the other compact bone.

The diagnosis of osteogenesis depends chiefly on the astuteness of the rhinologist. In all of the cases that I have seen there has been some prior intranasal instrumentation, ranging from the removal of polyps to radical intranasal operation for pansinusitis.

The subjective symptoms are: a sense of weight with dull pain over the entire frontal area and occasional facial neuralgia and orbital symptoms. Toxemia seems to be the most predominant and persistent subjective symptom, affecting chiefly the nervous and gastro-intestinal tracts.

Intranasal examination usually shows, in the fronto-ethmoid area, intermingled scar tissue with a hyperplastic membrane, occasionally polyps. The discharge is generally tenacious mucus or mucopus, but seldom frank pus. There is tenderness under the supra-orbital ridge of the affected side, and the sinus is dark on transillumination.

The roentgenogram shows the outline of one frontal sinus ending abruptly in the midline of the frontal area. The roentgenologist's usual report reads: "A failure of development or absence of one frontal sinus." To the uninitiated, this erroneous information is so misleading that they hesitate to advise such radical surgical measures as the removal of the external plate of the sinus in the face of such contradictory opinions and vague subjective symptoms.

If one will but recall from one's knowledge of anatomy that the frontal sinuses, in their upward development into the ascending ramus of the frontal bone, form a pyramidal cavity directly over the nasal fossa,[7] and that they will occupy this allotted space even though their relative shape and size may be inconstant, one will not be misled in interpreting a roentgenogram.[8]

It is true that the total failure of development of the frontal sinuses is not uncommon. Onoda reported 5 per cent in 1,200 specimens and Oppekofer 3.7 per cent in 200 specimens, and in the preparation of 54 skulls my associates and I were fortunate enough to find 2 such abnormalities.

Inequality in the size and shape of the frontal sinuses is a rather common finding. The roentgenogram often shows one large sinus encroaching on the space of its fellow. A single sinus occupying the entire frontal area has been reported, but R. H. Skillern [7] stated that "a complete absence of the intersinus septum never occurs."

The normal frontal area is divided in half by the continuation upward of the perpendicular line of the nasal septum. I have never seen, at operation or in a specimen, fully developed frontal sinuses confined exclusively to one side of this midline of the frontal area. Every roentgenogram showing one or more frontal cells ending against this perpendicular line with opacity of the space that should reveal the outline of its fellow was erroneously interpreted as showing absence of the sinus, not only by the roentgenologist but by several rhinologists. This was proved at operation and acknowledged as an error in diagnosis.

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7. Skillern, Ross Hall: The Catarrhal and Suppurative Diseases of the Accessory Sinuses of the Nose, ed. 4, Philadelphia, J. B. Lippincott Company, 1923, p. 282.

8. Skillern, S. R., Jr.: Clinical Versus X-Ray Diagnosis of Sinusitis, Ann. Otol., Rhin. & Laryng. **41**:1096, 1933; The Advantages of the Modified Lothrop Operation Over the Killian Procedure in the Treatment of Chronic Frontal Sinusitis, Tr. Am. Acad. Ophth. **33**:372, 1928.

Fig. 3.—A roentgenogram showing the left frontal sinus ending in the midline. The right sinus was reported to be absent.

Fig. 4.—A roentgenogram interpreted by the roentgenologist as showing absence of the left frontal sinus (see figures 5 and 6).

The roentgenologist reports only his interpretations of the plate; consequently, if the rays fail to penetrate the thickened, eburnated bone, the area of the sinus appears opaque, like the adjacent bone, with the demonstrable sinus shown occupying practically one half of the frontal area.

It is necessary for one to differentiate osteogenesis, with its generalized distribution of new bone, from osteoma, with its circumscribed encapsulation, and from mucocele and malignant and benign tumor. The latter growth sooner or later manifests itself in the nasal or orbital cavity, occasionally above the superciliary ridge, whereas osteogenesis is not demonstrable except in the roentgenogram.

Starting as it does from the point of injury, this new bony growth spreads upward and outward, like a fan, over the anterior wall of the affected sinus. It is thickest at the original point of bone excitation, growing thinner as it extends outward to be lost in the normal bone.

Points of interest are the central limitation of the growth at the intersinus septum, which is usually involved, and the thick, eburnated bone forming the floor, which walls off the sinus from the nasal cavity. In several instances, the thickening of the anterior wall had progressed to complete obliteration of the sinus. That the growth was in the anterior plate could be proved by demonstrating the smooth shining lining of the posterior wall of the sinus. That infection persisted was shown by cultures from the deeper recesses and pockets. A pure culture of Staphylococcus albus was found in all but one case, the culture in that one being negative.

The subjective symptoms, pain and a sense of weight over the frontal area, are due to the exostosis, with its irritation of the anterior ethmoid nerve, as described by Fenton.[9] The postorbital pain and otitic facial neuralgia are due to the irritation of the sphenopalatine ganglion [10] by the discharge, with its encrustations. The toxemia, with its manifold symptoms, can be caused only by lymphatic and vascular transmission through the haversian system. I have found that the numerous pockets of infection are encapsulated within the new bone filling the sinus, and, as there is no other means of absorption, it must be through the vascular system of the compact bone itself.

It has been rather difficult for me to convince some of my colleagues that the orbital manifestations of foci of infection are from an osteogenic frontal sinusitis, but, after all, the proof of the pudding is in its eating, and the removal of this infection within the bone has relieved the condition. It is therefore my opinion that the reason complete

9. Fenton, Ralph A.: Nasociliary Neuralgia Caused by Osteoma, Ann. Otol., Rhin. & Laryng. **42**:911, 1933.

10. Sluder, G.: Headaches and Eye Disorders of Nasal Origin, St. Louis, C. V. Mosby Company, 1918, p. 57.

relief is not obtained in many cases in which operation is performed is that these intra-osseous foci of infection have not been removed.

Complete relief from symptoms has been obtained in every case by the resection of the entire anterior wall above the superciliary ridge and the thorough removal of all tissues, until the posterior wall of the sinus was fully exposed.[8]

Dr. Frederick M. Law reviewed the films for this study and made the slides from them. He felt that the films were so poor that they should not be used for the purpose of demonstration. His criticism was confined to the making of the films and to the diagnosis made from such films.

Philadelphia surgeons are rather proud of their colleagues in roentgenology, but I must acknowledge that there has been no otorhinologist among them who has gone over to the specialty of otorhinoroentgenology; therefore, New York may claim originality in Dr. Law.

The illustrations presented here are shown as examples of roentgenograms in which the true condition was misintrepreted. Such pictures give the examining rhinologist the erroneous information that the focus of the infection cannot be, where in reality it lies, in the apparently absent frontal sinus. When the average roentgenologist can satisfactorily demonstrate the osteogenic proliferation obliterating the frontal sinus, then "he who runs may read," but until such time the diagnosis of this rare condition must, of necessity, depend on the astuteness of the examining rhinologist.

REPORT OF CASES

Case 1.—Mrs. L. L., aged 45, was referred to me in 1931, her chief complaint being constant dull boring pains radiating from the left mastoid to the midline of the face and paroxysmal sharp shooting pains over the area of the fifth nerve. These paroxysms were accompanied by pain in the posterior part of the nares and the left orbit.

The patient had been in normal health until 1917, when she had a severe attack of influenza. Sinusitis was diagnosed in 1918. Tonsillectomy and submucous resection were performed in 1920. In 1929 a diagnosis of tic douloureux was made, and injection of alcohol into the gasserian ganglion was carried out. A radical operation was performed on the left maxillary sinus in 1930. From the family physician's history and from the patient's numerous complaints, as well as from her general appearance, a diagnosis of neurasthenia could easily have been substantiated.

The present illness began on Nov. 17, 1931. Intranasal examination revealed a hyperplastic ethmoid area, with seropustular discharge from the sphenoid sinuses. The return washings from each maxillary sinus revealed milky white pus with a foul odor. A roentgenographic diagnosis of pansinusitis was made, the right frontal sinus showing the least involvement.

Bilateral ethmoidectomy and sphenoidotomy were performed on Jan. 15, 1932. On March 18 a bilateral Caldwell-Luc operation was performed. There was

complete regeneration of the walls of the left maxillary sinus, on which operation had previously been performed. The patient was comparatively free from pain and discharge until April 1933.

Following a so-called severe cold in the head, the pains and discharge recurred. Intranasal examination revealed the left sphenoid sinus closed by synechiae, except for an opening in the upper portion approximately 2 mm. in diameter. This sinus was filled with pulsating white pus. For the first time a seropustular discharge was noticed coming from the area of the left frontal sinus. Large encrustations covered the left posterior ethmoid area. Enlargement of the frontal ostium and removal of synechiae gave relief for three months. This procedure was repeated (by different methods) on two other occasions, giving but temporary relief.

On Sept. 15, 1933, external ethmoidectomy was performed on the left. A large supra-orbital ethmoid cell was found when the floor of the left frontal sinus was opened. As large an opening as possible was made through the septum of the frontal sinus to allow for aeration and drainage through a normal right frontal ostium. Deep in the curvature of the left orbital wall two infected posterior ethmoid cells were opened.

Following another intranasal infection, pains recurred in the area of the left mastoid and over the left frontal and maxillary areas. Intranasal examination showed crusting from the area of the frontal sinus to the face of the sphenoid sinus. The sphenoid sinus was partially walled off by synechiae but was apparently free from discharge. It was impossible to probe the frontal sinus. Five consecutive examinations, at weekly intervals, revealed the same crusting, which, when removed, gave relief from pains for variable periods of time.

On Feb. 26, 1935, radical operation on the frontal sinuses was performed (Skillern). The periosteum was very adherent over the left frontal area. A small trephine opening showed the anterior wall of the right frontal sinus to be 2 mm. in thickness. The left sinus was penetrated for 7 mm. without the sinus cavity being entered. When the bony plate of the wall of the right frontal sinus was removed, the loose lining mucous membrane was seen to fill and empty with each respiration, like a toy balloon, giving an excellent demonstration of sinus respiration. Inspection failed to reveal the opening made through the intersinus septum during the radical operation on the ethmoid sinus in 1933.

As the full thickness of the anterior wall, with its new bony growth was desired for histologic study, the left frontal sinus was attacked by hammer and gouge through the septal wall. When the small half-round gouge had penetrated 1 cm. without entering the sinus cavity, this point of attack was abandoned for the usual incision of the bone above the superciliary ridge. The sinus cavity was outlined with the Killian V chisel in accordance to the measurements taken from the roentgenogram; then, with a broad flat chisel, an attempt was made to remove the anterior wall in toto. This, as in the other cases, met with failure, as when the piece was removed there remained a layer of eburnated cancellous bone covering the posterior wall. Numerous pockets were found from which a pure culture of Staph. aureus was obtained.

When the very hard dense layer of bone forming the floor of the sinus was broken through, the ostium, enlarged at the former operation, was found to be completely closed by scar tissue.

Drainage was established into the nose by rubber tubing. The wound was closed by sutures. The tubing was removed in twenty-four hours and the sutures in forty-eight hours. Uneventful recovery followed. The patient was discharged on the fifth day.

On May 15 the patient was seen seated in the waitingroom. Her general appearance and mental state were so changed that my nurse and several patients spoke of her improvement.

When ushered into the office her first remark was: "I have come to pay my bill, not to see you, as I have no further need for a doctor." In our conversation, she stated: "I have not felt as well for years. I feel as though some terrible load has been lifted from my mind. Before, if any one so much as pointed a finger at me, I felt like bursting into tears. Now, I can take my own part in any argument. All of the pains and aches have gone, and I can eat food that I would not have dared to touch a year ago, and as far as work is concerned, I can do five times as much as before the operation."

The removal of the foci of infection from the osseous tissues, thus eliminating the source of toxemia, is responsible for a so-called typical neurasthenic patient's return to a normal condition.

CASE 2.—Harry M., aged 23, a printer, was first seen by Dr. Bobb, of Reading, Pa., in August 1934, from whom the history was obtained. The patient's condition was of two years' duration. There were polyps filling both nares, making nasal breathing impossible. All the sinuses were dark. There was pus in the nose and in the pharynx. Dr. Bobb removed all the visible polyps and reported that the antral washings showed heavy, thick, ropy, white pus. He felt that the ethmoid cells and antrums were filled with diseased membrane and stated that the condition was growing progressively worse. There was no history of headaches or of pains.

Examination on Feb. 8, 1935, showed the nasal cavities to be completely occluded by pus, polyps and hyperplastic tissue. All the sinuses were dark. Washings from the right maxillary sinus showed milky white pus (4+) and those from the left maxillary antrum also showed milky white pus (3+).

A diagnosis of purulent hyperplastic pansinusitis of two years' duration was made. There was no history of operation on the sinus.

A roentgenographic report, made by Dr. Kornblum, gave the following data: The frontal sinuses were rather small. There was a complete obliteration of the frontal sinus on the left side by new bone formation. Its outline was barely visible. There was a large ethmoid cell projecting upward into the frontal region. The right frontal sinus was hazy. There was clouding of the ethmoid sinuses on both sides. The maxillary sinuses were markedly thickened by the mucous membrane lining both sides. The right sphenoid sinus was clouded and the left was hazy. There was an increased density of the bones about the paranasal sinuses such as is commonly seen in infection of long standing. The conclusion from the picture was that the condition was pansinusitis with complete obliteration of the left frontal sinus by proliferative osteitis.

On February 12 bilateral ethmoidectomy was performed. All of the cells were found to be filled with a thickened polypoid membrane and pus. The sphenoid sinuses were opened, and the membrane was found to be polypoid. The anterior walls of the sphenoid sinuses were removed. Uneventful convalescence followed.

On February 19 radical operation was performed on the frontal sinuses above the superciliary ridge. The right frontal sinus was opened through a thickened anterior wall, and the sinus cavity was found to be filled with gelatinous pus and a thickened, loose membrane. A large supra-orbital cell was opened through the floor of this sinus. An attempt was made to perforate the intersinus septum. This was abandoned after the gouge had penetrated 1 cm. into the area of the left frontal sinus. The anterior wall, beginning within the outer confines of the sinus, was chipped away until the smooth white bone of the posterior wall was

fully exposed. After removal of the floor, which was of dense eburnated bone, the gouge suddenly entered what my assistants thought to be the orbital cavity. Pressure on its yellowish-white, glistening contents failed to disturb the orbit. Enlargement of this opening demonstrated a large supra-orbital cell completely filled by a single fibrous polyp. After the removal of this thickened false floor of the frontal sinus, the normal frontal ostium could be demonstrated. Both frontal sinuses were thrown into one large cavity, and rubber drainage tubes were inserted into each enlarged ostium. Convalescence was complicated by stitch abscesses involving the upper eyelid. Recovery occurred in three weeks, with marked improvement in the asthmatic condition.

Six weeks later acute mastoiditis developed, which required surgical intervention. Following this operation the patient gained 12 pounds (5.4 Kg.) and was greatly improved.

At the time this paper was written the patient was recovering from a radical operation on the maxillary sinuses, which showed both sinuses to be filled with degenerated mucous membrane, polyps and pus. No asthmatic seizures have occurred since this last operation.

CASE 3.—B. B., aged 25, was referred by an ophthalmologist with a diagnosis of neuroretinitis affecting chiefly the color fields. The patient said that she had not had all of the usual subjective symptoms of sinusitis. She complained chiefly of nausea and vomiting following the use of her eyes (reading) for longer than from ten to fifteen minutes. Bilateral ethmoidectomy, sphenoidotomy and a radical operation on the maxillary sinus had been performed in 1920 and 1930. Following each of these operations the ocular condition improved.

Her present complaint was of a dull heavy sensation over the left side of the forehead. If the eyes were used continually for an hour for close work, the former symptoms of headache with nausea and vomiting occurred.

Intranasal examination showed that the ethmoid cells and also the anterior wall of the sphenoid sinuses had apparently been removed. There was a large window beneath the inferior turbinate bone. The right side was free from all discharge or encrustations. The left ethmoid area was covered by crusts and the sphenoid area by synechiae. A thin seropustular discharge was noted in the fronto-ethmoid area.

With transillumination, the right frontal sinus showed an abrupt ending of the light at the midline of the forehead. No transmission of light could be seen on the left side.

The roentgenologist's report was confirmed by the films: There was failure of development or absence of the left frontal sinus. The remaining sinus area was opaque, probably from scar tissue of previous operations.

The results of the second and subsequent intranasal examination were similar to those of the first examination. The right nasofrontal duct was patulent and easily probed, whereas it was impossible to sound the left frontal sinus.

On July 25, 1932, a radical operation was performed on the frontal sinuses (Skillern). The right frontal sinus was apparently normal. The left was filled with eburnated cancellous bone containing pockets of degenerated membrane and seropus, which on culture yielded a pure growth of Staph. aureus. Recovery was uneventful, with relief from all former symptoms, and the patient is now in apparent excellent health.

CASE 4.—Rev. G. B., aged 46, first consulted me in February 1929 with the complaint of constant dull headache over the left frontal and temporal areas and of a feeling of fulness and pain in the left ear. According to the past history

he had a severe attack of sinusitis, for which radical operation had been performed on the maxillary sinuses in 1926. Turbinectomy on the left side with removal of polyps had been carried out in 1927. Ethmoidectomy was performed in 1928.

Examination showed crusts covering the left ethmoid area. The sphenoid sinus was almost completely closed by synechiae. A small opening in the upper half was filled with white pus. A seropustular discharge from the frontal area was noted.

According to the roentgenographic report by Dr. Manges there was no frontal sinus to the right of the median line. There was a divided frontal sinus on the left side.

Dr. Widmann's report on March 13, 1929, stated that the left frontal sinus was of average normal size and contour and was clear. The surrounding bone structure was of average normal density and was healthy. The outline of the right frontal sinus was indeterminate. The density in this region was compatible with that of osteitis of a chronic infection of the bone. Dr. Widmann believed that the density of the area of the right frontal sinus as compared with the transparency of the left frontal sinus was more apparent than actual, being due to increased thickness of the bone in this region. The anteroposterior depth at the base of the left frontal sinus was about 8 mm. This permitted free and wide aeration on the left side.

A report on March 16 added that further roentgenographic study of the region of the frontal sinus revealed a probe in situ in the sinus. This was clearly and definitely within the frontal sinus, the outline of which was obscured by disease —probably density of bone due to osteitis plus extensive exudation. The upper limits of the sinus cavity were blurred and diffused with the surrounding bone structure because of this extensive disease. The large cell of the left frontal sinus, which probably should be called a median cell but was definitely to the left of the median line, presented a haze of a sufficient degree and character to be regarded as also disease with exudate. Incidentally, the bone detail and fine lines of the ethmoid, sphenoid and maxillary regions were shown very distinctly and clearly in various projections and substantiate the original report of March 12. In summary, the opacity of the right frontal sinus indicated definite disease with probably involvement of the bone and this diagnosis was decisively proved by a roentgenogram showing a metal probe in situ in the anteroposterior and frontal views.

On April 2 a radical operation was performed on the frontal sinuses (Skillern). The anterior wall of the left frontal sinus was 5 mm. in thickness. There was a mucopurulent discharge. The anterior wall of the right frontal sinus was from 8 to 9 mm. in thickness. The entire sinus cavity was filled by eburnated bone, except for a small canal leading upward from the ostium to the termination of upper extremity of the sinus. Uneventful recovery followed, with complete relief from all pain and nasal discharge.

Note (May 15, 1935).—The patient is seen once or twice weekly and has been and is in excellent mental and physical condition.

Case 5 is such an unusual one that I feel that the past history must be taken into consideration in making the final summation as to the likelihood of surgical intervention giving permanent relief.

Case 5.—G. T. Jr., aged 19, was referred to me on Nov. 1, 1932. His chief complaint was chronic purulent sinusitis, asthma and epileptiform seizures.

According to the past history, he had influenza at the age of 8, resulting the following winter in chronic purulent nasal discharge, with intermittent severe

Fig. 5.—A roentgenogram confirming the presence of the allegedly absent left frontal sinus by showing a silver probe in the sinus.

Fig. 6.—A lateral view of the area shown in figure 5.

headaches. The following year, symptoms of asthma developed, which have persisted at irregular periods. When the patient was 14, the first epileptic attack occurred. These muscular spasms are now periodic, occurring from every eighteen to twenty days. The attacks start in the right hand which becomes spastic, with coarse jerking tremors. These muscular spasms extend upward to involve the entire body. The attack is apparently a typical epileptic seizure, although the patient never loses consciousness, and he can repeat sentences heard throughout the entire attack. He never voids or injures himself in any way during one of these seizures.

At the age of 16 he was studied by Drs. McCarthy, Temple Fay, Flick and Manges, and a diagnosis of epilepsy and pulmonary tuberculosis was made.

According to Dr. Manges, the roentgenographic study revealed pansinusitis, an apparent absence of the bony wall (wings of the sphenoid) dividing the left anterior from the middle fossae of the skull, absence of signs of new growths or calcifications within the cranial cavity, no unusual blood channels in any portion of the skull and no changes in the sella turcica or evidence of increased intracranial pressure.

When the patient was 17, Dr. Walter E. Dandy made a diagnosis, by means of a large frontoparietal osteoplastic flap, of congenital malformation of the brain, with a very large vein traversing the left motor area. Intranasal operation on the ethmoid sinus and a radical operation on the maxillary sinus were performed at the age of 18.

The symptoms continued, and the asthmatic attacks became more frequent and were of longer duration and of greater severity. Nasal breathing was almost completely obstructed, with a continual heavy pustular discharge.

Intranasal examination showed both nares so filled with pus that nasal irrigation was necessary before further examination could be made. Both nares were filled with large polyps, removal of which revealed a sloughing mass of polypoid and scar tissue covering both spheno-ethmoid areas. The opening beneath the inferior turbinate bone was completely closed by thickened, eburnated bone. The surgical opening into the right sphenoid sinus was almost completely closed by synechiae. There was a large mass in the left posterior ethmoid area completely hiding the sphenoid sinus. It was impossible to sound either frontal sinus.

Dr. Piersol's report of his medical examination stated that there were a healed tuberculous lesion in both lungs, asthma and bronchiectasis. The cardiovascular and renal systems were normal.

Neurologic examination was performed by Dr. T. Weisenburg, who made a diagnosis of epilepsy.

Over a period of three years Dr. Manges has made numerous roentgenographic studies of the skull and sinuses, and he stated that in all of his films there is no evidence that there has ever been a right frontal sinus. He reported that his most recent films showed a slightly greater amount of aeration in the left frontal, ethmoid and sphenoid sinuses than in the former films.

The consensus was that operation on the sinus was essential for the removal of foci of infection.

Scar tissue and polyps were removed intranasally from the ethmoid areas, exposing a small left sphenoid sinus, which, when opened, was found to be filled with degenerated mucous membrane, polyps and pus.

One week later radical operation was performed on the frontal sinuses (Skillern). The left frontal sinus was of normal size and shape, but was filled with a peculiar dark greenish, semisolid, jelly-like mass, smears from which failed to show growth on cultures.

The right frontal sinus was completely obliterated by a bony growth. This new bone was made up of spots of ivory-like density, with intervening areas of softened bone and degenerated membrane. Swabs from this area showed a pure growth of Staph. aureus on the culture mediums.

Convalescence was uneventful except for a very severe asthmatic seizure on the third and on the fifth day. There were no further asthmatic attacks or epileptic convulsions during the patient's three week stay in the hospital, following which he returned to his home in a distant city.

I have recently learned that his asthmatic symptoms have shown improvement in that they are less frequent and of a shorter and milder character. There was but a slight, if any, improvement in the epileptic seizures.

It was definitely understood by all concerned that the operation was to remove the foci of infection, and it was hoped that this might improve the patient's general health, which, in turn, would favorably influence his asthmatic and epileptiform seizures.

It might be well to mention that all of the usual routine laboratory examinations, such as Wassermann tests, blood counts, urinalysis and bacteriologic and pathologic studies, were made for each patient, but only the findings thought to be of importance have been mentioned.

I was extremely anxious to get a slide of a microscopic section of the full thickness of the anterior wall and sent a specimen from each of the last eight patients to the laboratory, but the pathologist has been unable to obtain a satisfactory section. He stated that the bone is so hard and requires so long to decalcify that all osteoblasts and new bone cells are destroyed by the decalcifying solution before a section can be cut for microscopic study. The chips from the softer bone do show growth of new bone.

CONCLUSIONS

1. Obliterative frontal sinusitis, being an osteogenic thickening resulting from a pathologic stimulus, may be classified as a benign bony tumefaction.

2. Osteanagenesis is nature's protective mechanism to the dispersion of infection.

3. Osteanagenesis depends on the ability of the compact bone to responded to a bacterial or traumatic stimulus.

4. Unilateral osteogenic thickening, affecting chiefly the anterior plate of one frontal sinus, is the usual finding.

5. Obliterative frontal sinusitis is often erroneously diagnosed from the roentgenogram as a failure in development, or an absence of, the affected sinus.

6. The roentgenogram should be used only as "a helping hand" to the diagnosis.

7. No roentgenographic diagnosis of disease of the paranasal sinuses, especially if negative, should ever be accepted without the confirmation of a rhinologist.

8. Failure to make a correct diagnosis has occasioned multiple intranasal operations without giving complete relief from symptoms.

9. When the roentgenogram shows a large unilateral frontal cell ending abruptly at the midline of the forehead, its fellow should be suspected of osteonagenesis.

10. Radical operation above the superciliary line has been proved to be the operation of choice.

DISCUSSION

DR. FREDERICK M. LAW, New York: Sometimes an x-ray film shows a very faint outline of what one thinks may be a frontal sinus, but it is indefinite. One turns to the lateral film and sees an outline of the sinus on the opposite side, the cavity filled with dense material. No amount of exudate, granulations or pathologic material outside of bone will show on a lateral film. Such material is transparent; bone is not transparent; therefore, a diagnosis of the presence or absence of a bony cavity is based on the appearance of a lateral film.

The lateral films are of two distinct types: There are films in which the sinus on the side on which such a cavity is obviously present shows an anterior and a posterior wall, a definite outline, and there are films which show no outline on the side from which one thinks the sinus may be absent; on the other hand, there are films which show a hazy, indefinite outline. One concludes that the frontal sinus is absent.

In order to have a frontal sinus obliterated by bone there must have been a frontal sinus present at some time. The outlne of that is not obliterated on a film by the consequent overgrowth. There is an outilne remaining similar to that remaining in the sclerotic mastoid, and properly made and properly interpreted sinus films demonstrate a difference in those two types of cases.

One can say that there is an apparent absence of a frontal sinus, but the content or the consistency or the thickness of that cavity is less dense than of that on the opposite side, and that is as far as one dares go.

It is necessary to learn more about this. When films are received from the roentgenologist n which the absence of a frontal sinus is shown both in the anterior-posterior view and in the lateral view, do not be satisfied. Return the patient to him and ask for films made in the chin-nose position, whereby one gets an image up through the orbit; this may outline an anterior and a posterior wall. Also ask for a stereoscopic pair made obliquely through the orbit. In other words, get films made so as to distort the frontal sinus so that the walls will not be superimposed; there will be a double outline if a posterior and an anterior wall are present.

DR. THOMAS E. CARMODY, Denver: Why infection should stimulate formation of bone in one case and simply formation of pus and granulation tissue in another is something that one cannot say. My associates and I have done a great deal of work on the development of the frontal sinus and the effect of infection of the other sinuses on the development of the frontal sinus, and we have found absence of a frontal sinus in children rather frequently. That is, of course, a proposition entirely different from this, because the two layers are close together.

DR. WILLIAM B. CHAMBERLIN, Cleveland: I understood Dr. Skillern to say that this condition was due entirely to osteogenesis of the anterior wall, and that in opening up the frontal sinuses he found the shiny posterior wall uninvolved. He did not state whether or not he found periosteum and mucous membrane covering the posterior wall.

Dr. George M. Coates, Philadelphia: The first cases that I noticed were not, strictly speaking, of the type which Dr. Skillern describes. They followed operation on the frontal sinus, particularly operation of the Lynch or Sewall type, with removal of the anterior wall rather than the frontal table. I ran across two or three in which operation was needed and found the sinus entirely obliterated. That may be common enough, but when Dr. Skillern began to find cases in which the frontal sinus had not been operated on, in which there had been a minor operative procedure in the nose only, it seemed that the thing might have more significance.

The degree of the osteogenesis that takes place, of course, depends on when the physician sees the sinus and opens it. When the sinus has been practically entirely obliterated, after careful removal of the new growth, which is more or less soft bone, one comes to the original inner wall of the sinus and finds that it is intact. It seems definite that the growth takes place from the anterior wall. In some of the cases in which the sinus was entirely obliterated the nasofrontal duct was obliterated also, and there was no passageway into the nose.

Dr. Joseph C. Beck, Chicago: I have just been fortunate enough in the last week or two to see a case, and I have proved microscopically that it was of the type of disease spoken of here as osteogenesis: A man about 30 years old complained continually of a headache over the frontal region, definitely across both sinuses. He consulted a rhinologist, who referred him to a roentgenologist. The x-ray films showed a normal frontal sinus. Nevertheless, this patient wanted to consult a second rhinologist. The latter, without looking at the x-ray films, passed a frontal sinus probe. The patient was seen by me three months later, and another x-ray film was taken. At this time there was definite obliteration of one frontal sinus. Because the patient complained very bitterly of pain in the frontal region operation was done. An obstruction of the frontal sinus was found which appeared to be an osteoma but was differentiated by histologic examination.

Recklinghausen's disease must not be forgotten, and Dr. Chamberlin's point is important in that respect.

Dr. S. R. Skillern, Philadelphia: I have been ten years trying to collect these twelve cases. I never think of operating in a case of this type without an extensive study in consultation with the roentgenologist.

As far as the posterior wall goes, it is hard to say whether or not there is any mucous membrane present.

The mucous membrane, I have found, Dr. Chamberlin, has been shredded and loosened from the posterior wall. What the condition of the posterior wall is, I am not prepared to say.

RHINOSCLEROMA—IS IT AN INDIGENOUS DISEASE?

WILLIAM B. CHAMBERLIN, M.D.
CLEVELAND

Many of man's greatest inventions have been for the annihilation of distance or space, in making possible instant communication between persons and places widely separated, thus enabling him to transport not only himself but his chattels and products over vast areas in comparatively short periods. This victory over space has brought its sorrows as well as its blessings, its pests and likewise its pleasures, its advantages as well as its disadvantages. So a disease whether of plants or of animals at present rarely remains for a long time confined to any one area or locality but, owing to the increased facilities of travel and transportation, soon finds its way over the entire civilized world, wherever climatic conditions may permit its development. In plant life one recalls at once the San José scale, the chestnut blight, the white pine blister, the Tussock moth and now the Dutch or elm tree beetle, threatening the total destruction of elms as the blight has already destroyed the chestnut trees. The epidemic of infection with Endamoeba histolytica, having its origin in Chicago, soon found its way into almost every corner of the United States and Canada.

Similarly, rhinoscleroma, or scleroma, as it is more properly called, when first described by Hebra in 1874 seemed to confine itself almost exclusively to the inhabitants of southwestern Russia and the Balkan Peninsula. But especially in the last ten years cases have been found practically throughout Europe, with some cases in South America, Japan, China and Sumatra, many more in Central America and few sporadic ones in North America as well. Reyes has reported three hundred cases in San Salvadore, mostly in workers with deep blue aniline dyes, and has suggested that there may be some organism in the dye which is a causative factor.

Frisch in 1882 described a bacillus which is easily obtained in all cases, not only in cultures but in tissues as well; but this bacillus of Frisch morphologically closely resembles the bacillus of Friedländer and of Abel and shows a variety of protean forms when grown on different culture mediums. It fails to satisfy the postulates of Koch, and so the etiology of the disease as well as its mode of transmission

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is still a matter of conjecture. Characteristic microscopic lesions have been produced in animals, notably white mice and rabbits, but there have been no instances of the successful transmission of the disease itself. Róna inoculated the ear and cheek of a patient with cultures of the bacteria, and Simoni placed pledgets of cotton soaked in the secretions from the nose of a patient in the nose of a second patient, without result. Von Schroetter went still further and placed bits of scleromatous tissue beneath the skin of his own arm, but he was unable to infect himself. By some the disease is thought to thrive only in unhygienic surroundings, and so national or even international measures have been advocated for its control. Lasagna has reported eleven cases as occurring in the same family, country people of one village, and Figi has called it "the disease of the great unwashed."

Pathologically it is an especially chronic disease of the upper air passages which becomes localized in the mucosa and submucosa and may attack first the nose, the nasopharynx or the larynx. It may even attack first the nose and then the larynx, or vice versa, leaving the intervening mucosa and submucosa entirely uninvolved. Likewise, it may be confined to one of these three locations without involving the other two. Most authors speak of three stages: (1) a catarrhal stage, characterized by profuse secretion and crust formation in the nose, closely resembling atrophy; (2) a stage of tumefaction or proliferation, small tumor masses ultimately coalescing to form larger ones, and (3) a stage of cicatrization or concentric stenosis, causing a marked narrowing of the air way.

The tumor masses are at first soft and red and do not tend to ulcerate, unless irritated through trauma or when involved by secondary infection. Death always results from intercurrent complications and never apparently from the disease itself, the victims not infrequently living to an advanced age. In the larynx the disease is always bilateral and subglottic and must be distinguished from acute and chronic swelling, as well as from tuberculosis, syphilis and perichondritis. Involvement of the trachea and bronchi is always secondary and late in the course of the disease.

Histologically the disease is characterized by the presence of vacuolated cells, which were first described by Mikulicz. These are also described as foam or lace cells and contain the bacteria, often in large numbers. The sections show also frequent masses of hyaline tissue, or Unna bodies, as they are sometimes called. As the sclerosing process supervenes these characteristic cells are gradually lost, their presence or absence depending largely on the stage of the sclerosing process.

The chief symptom of scleroma is a gradual impairment of respiration, either nasal or laryngeal, depending on the site of involvement, with no pain or dysphagia and with no impairment of the voice. In my first patient the voice was fairly normal, although a tracheotomy

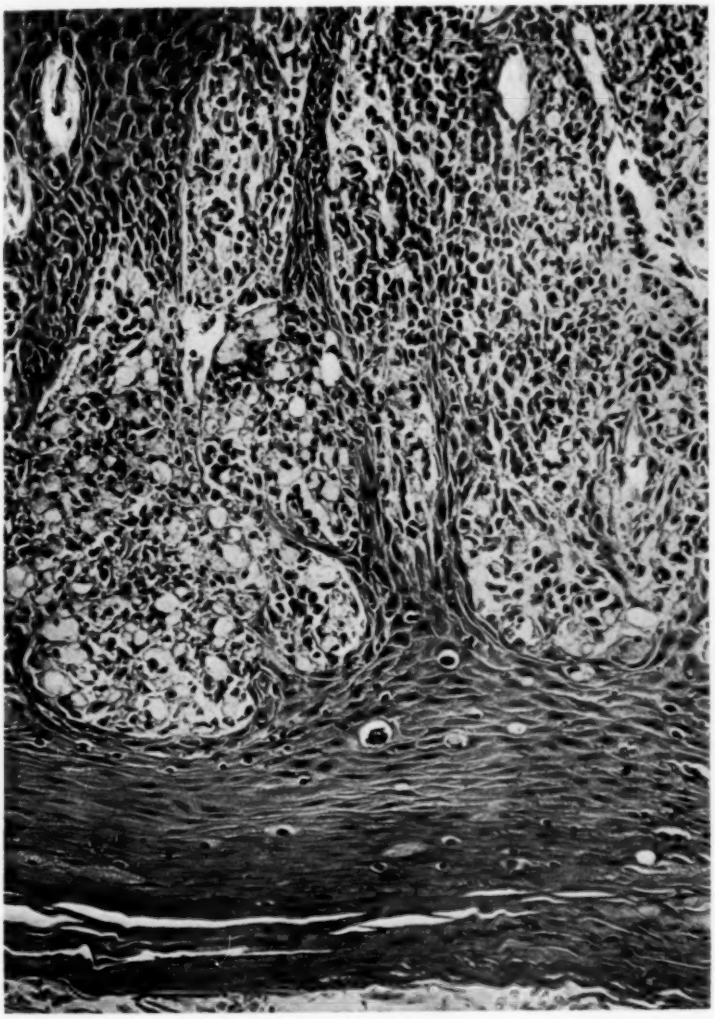

Fig. 1.—Surface epithelium infiltrated with leukocytes and lymphocytes. Immediately beneath it are clusters of Mikulicz and epithelioid cells.

had been performed to relieve the obstruction. Yet the finest probe could not be passed through the larynx with the patient under general anesthesia, either from above downward or from below upward, through

the tracheotomy wound. In my second patient there was some pain, and the nose was so extremely tender that an entirely satisfactory examination of the depths of the nasal fossae could not be made, even

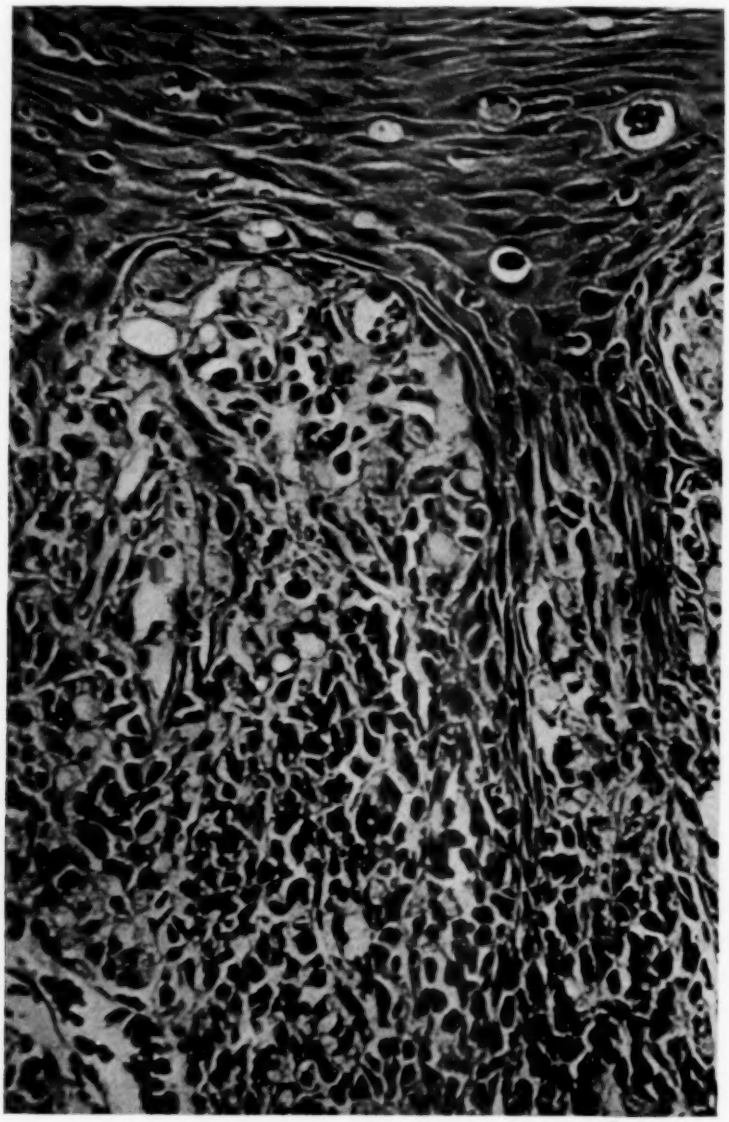

Fig. 2.—Surface epithelium. Several Mikulicz cells are seen, one of which (in the center) shows the partitions produced by the small vacuoles.

with the patient under attempted cocaine anesthesia. For the resecting of bits of tissue from the anterior nares and especially the anterior part of the septum, cocaine had little or no effect, and infiltration of 0.5

per cent procaine hydrochloride only partially relieved the discomfort of resection.

Before the introduction of the roentgen rays and radium various therapeutic measures were tried without result, notably excision, cauterization and diathermy, as well as autovaccination, aggressins and neoarsphenamine. Hassan Bey Shaheen reported favorable results from

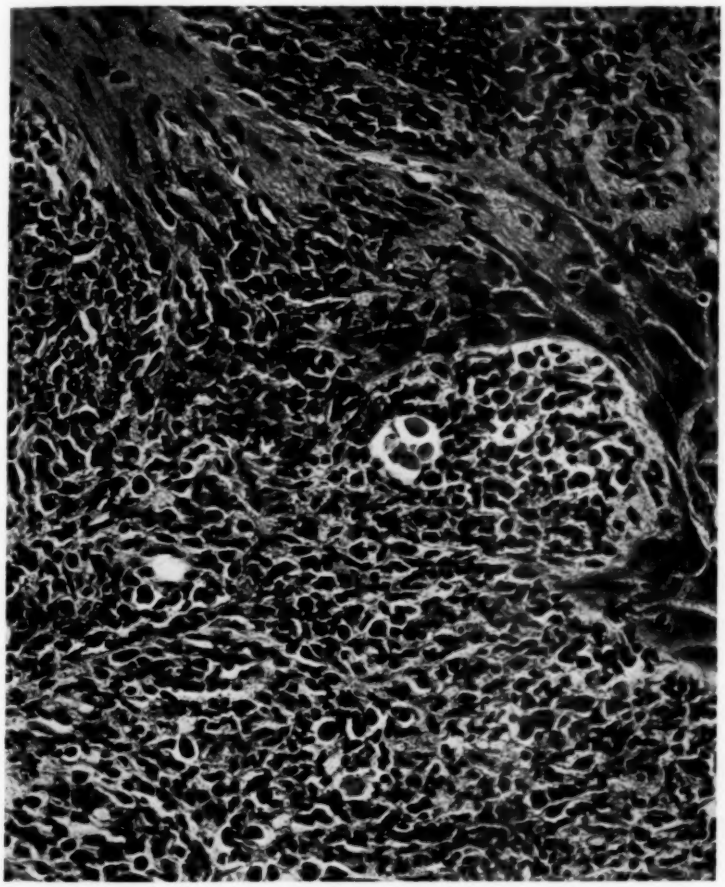

Fig. 3.—A cluster of four hyaline bodies is seen, probably situated in a lymphatic vessel. Two other small bodies are present in the opposite end of the section, one of them showing a nucleus about to be extruded.

the injection of colloidal iodine, with a possible cure in one case. Radium and roentgen rays at the present time seem to offer the greatest assurance of arrest or cure, although no therapeutic measures are of value after firm cicatrization has taken place. In the nose and nasopharynx dilation is of little value. In the larynx, however, the dilators devised

many years ago by von Schroetter are still of value in maintaining patency and in postponing, if not avoiding, the day when tracheotomy must be resorted to. When dyspnea becomes severe, however, tracheotomy is unavoidable.

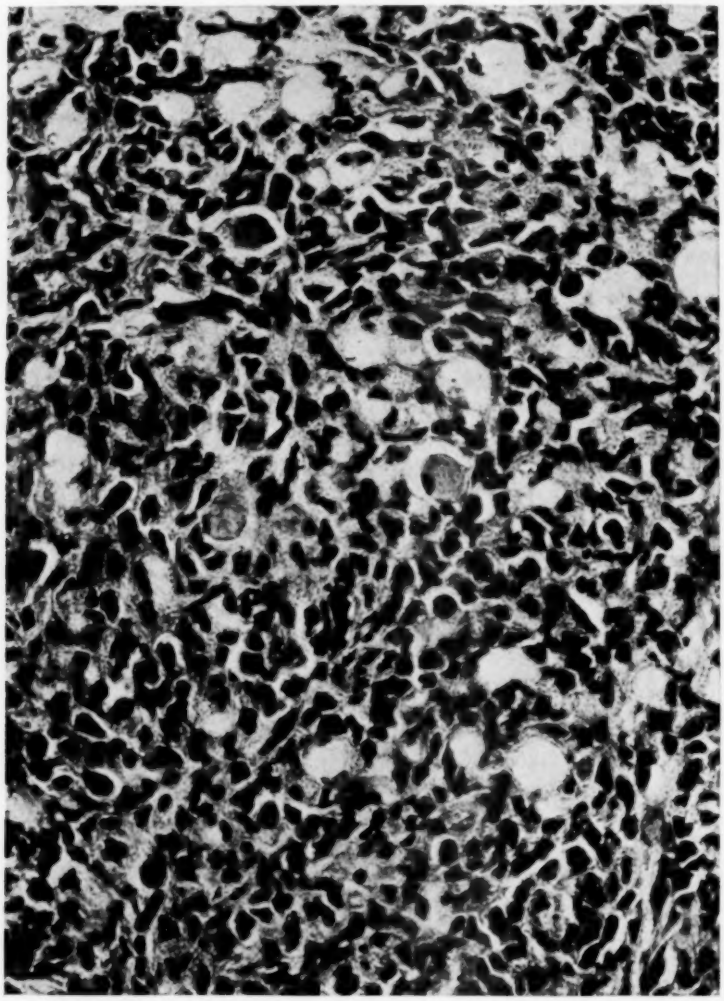

Fig. 4.—Two hyaline bodies are shown, one of which has a nucleus that is about to be extruded.

Two patients with rhinoscleroma have come to my attention during a period of thirty years in clinical work. So far as I know these have been the only patients with this disease in the Lakeside Hospital and in all the hospitals of Cleveland.

The first patient, seen in 1914, was a Russian, 24 years of age. He had come to the United States eight years previously and one year later began to experience difficulty in breathing. This patient was subsequently reported on by Gleitsman, who excised bits of tissue from the larynx three times in four years and ultimately

Fig. 5.—Mikulicz cell containing bacilli stained with methylene blue.

performed a tracheotomy. In 1914 I removed masses of tissue both from above and from below the vocal cords. Although the voice was somewhat hoarse it was of good volume; however, a probe could not be passed through the larynx even with the patient under general anesthesia. I have kept in touch with this patient ever since. When last seen he was still wearing a tracheotomy tube; otherwise

his health was excellent, the disease apparently not having progressed to the trachea or bronchi. The nose and nasopharynx were uninvolved.

The second patient, a Russian aged 52, came to this country twenty-six years ago. His family history was unimportant. He was wounded in the left side of the chest in 1916 and had a serious infection of the dorsum of the right hand in 1928, which required incision and drainage. Otherwise his health had been excellent. He worked as a laborer until two years ago, since which time he had been unemployed. About fifteen years ago he first complained of nasal obstruction with excessive crust or scab formation. Later he noticed a growth on the right side of the nose. The growth was painful but never bled unless it was disturbed. One year later a portion of this growth was excised, as were other masses on several occasions since then. Recently the growth had become more painful and tender and had increased in size, thereby increasing the nasal obstruction.

The description of the examination made by Dr. H. W. Allen, one of my assistants, reads as follows: "The nose appears to be thickened at the tip and in the region of the alar cartilages. There is marked widening of the columella, due to a proliferative mass involving the skin and mucous membrane of both anterior nares, more markedly on the right. The granulomatous growth is pale, hard, extremely tender and painful and is covered with a thin, dry crust.

"The tumor extends along both sides of the septum and involves the lateral walls of both vestibules. The remainder of the nasal cavity appears dry, with a thickened mucous membrane. The full extent of the lesion cannot be determined because of the extreme tenderness and the failure of the mucous membrane to respond to shrinking solutions as well as cocaine.

"On direct examination the uvula is not apparent. The two anterior pillars appear to be under tension, meeting in the midline. The posterior pillars are practically fixed and retracted upward, especially the right one, so as to bring the right tonsil into view. From the medial surface of this tonsil a leukokeratosis extends backward to the posterior pillar and up the lateral wall of the pharynx and nasopharynx. With the mirror is seen a marked contraction of the nasopharynx, apparently due to encroachment of the lateral wall toward the midline as a result of infiltration and cicatricial contraction. The uvula is seen projecting upward and backward into the nasopharynx. As a result of this atresia the landmarks of posterior rhinoscopy are not visible."

Closer inspection with the mirror showed that the uvula was intact but drawn upward and backward by strong bands of cicatricial tissue, so that when one looked directly into the mouth the uvula appeared to be amputated at its base. The remainder of the nasopharynx was filled on either side with masses of dense, firm cicatricial tissue. The posterior border of the septum could be recognized, but the eminence of the eustachian tubes could not be seen, although there was little impairment of hearing. The larynx and epiglottis were normal, and the voice was unimpaired.

On the last examination, May 15, there was seen to have been a marked increase in the stenosis of the nasopharynx. The posterior border of the septum could still be seen through a round sclerosed opening about 1.5 cm. in diameter, or the size of the average postnasal mirror. Three applications of radium had produced a markedly beneficial effect on the condition of the anterior nares and vestibule. There was a marked decrease in the size of the growth, the pain had practically disappeared, and there was much less tenderness to pressure. The radium was applied as follows: One 50 mg. tube, screened with 5 mm. of silver, 1 mm. of brass and 1.5 mm. of aluminum, was applied so as to come in contact with the surface of the lesions for three hours, thus making a dosage of 150 milligram hours. There

had been two surface applications and one implant of two gold seeds of 1 millicurie each. (Ranzi first reported the treatment of rhinoscleroma with the roentgen rays in 1904, and Kahler, in 1905, was the first to use radium. Before the Pan American Medical Congress in 1908 Wunderlich, of Guatemala, reported three cases in which a cure was obtained, and later he reported fourteen additional cases in which cure was obtained.)

Examinations of the tissue, cultures and smears were made by Dr. Harry Goldblatt and Dr. E. E. Ecker, of the department of pathology of the School of Medicine of Western Reserve University. Dr. Goldblatt's report reads as follows:

"The surface epithelium is squamous, of irregular outline and of variable thickness. In some places it is greatly thickened and projects deep into the corium. Parts of the surface epithelium are covered by a thick layer of keratinized cells. The basement membrane is intact. The surface epithelium is moderately and diffusely infiltrated by polymorphonuclears. The corium is trabeculated. Between the trabeculae, which consist of dense, partly hyalinized connective tissue, are masses of plasma cells and lymphocytes between which are interspersed numerous large cells with pale-staining, foamy cytoplasm. In a few areas there are nodules which consist practically entirely of these large foamy cells. Some of the nodules are situated immediately beneath the surface epithelium. The infiltration of the plasma cells, lymphocytes and foamy cells (Mikulicz' cells) extends into the subcutaneous tissue and to the lowermost limit of the sections. Special stains for the demonstration of bacteria within the foamy cells show the presence of a number of gram-negative bacilli.

"The diagnosis is: granulomatous inflammation of the nasal mucous membrane (rhinoscleroma)."

Dr. Ecker's report was as follows:

"Swabs from the nose and throat show a Friedländer-like bacillus which is culturally and morphologically identical with Encapsulatus rhinoscleromatis. This organism has been isolated in pure culture several times.

"Cultures were made of pieces of tissue from the nasal vestibule and also of material taken with a platinum loop directly from the pharynx. The materials were streaked on blood agar and plain agar plates, and within twenty-four hours large numbers of colonies of organisms belonging to the mucoid encapsulated group were observed. Smears of the colonies showed the organisms to be pleomorphic rods of variable size with rounded ends. They appeared to be nonmotile, showed a capsule and were gram-negative. The intracellular mucoid was characteristic of the group. The organisms were aerobic.

"The growth on agar was white, translucent, moist, smooth and sticky. Litmus milk was acidified and clotted, but the clot was not broken. Dextrose, lactose, sucrose, inositol and maltose were acidified but with no gas formation. Mannitol showed little or no change, while arabinose, dulcitol and xylose showed no change. Rhamnose gave a slightly acid reaction. Gelatin was not liquefied. Clotted blood serum was not changed. The organisms failed to produce indole, and nitrates were reduced to nitrites.

"The organisms of the Klebsiella group vary greatly. The organism of rhinoscleroma (Klebsiella rhinoscleromatis) was described by Frisch in 1882, and Wilde stated in 1896 that by its not forming gas in dextrose broth, not producing acid in lactose broth and not coagulating milk it could be distinguished from the Friedländer bacillus. But Small and Julianelle observed strains of the Friedländer bacillus which possessed similar biochemical characteristics. Variability in the organisms of the rhinoscleroma group has also recently been described by H. Weisels and E. Mikulaszek."

COMMENT

In neither of the two cases here reported was the patient a native-born American, although in the second case, owing to the patient's long sojourn in this country (twenty-six years) there might be more than a suspicion that the disease was indigenous. The patient's home surroundings were not inspected, but he was always fairly well dressed and of unusually cleanly habits. He was of more than average intelligence and could not remember having been in contact with any person with a similar disease either in Russia or since his arrival in this country. Emil Mayer, writing in 1908, after a careful review of the literature stated that no authentic case had ever been reported in a native-born American. Since then cases in native-born Americans have been reported by Wende, Watkins, Wood, Figi and Canfield. Helwig and Jaime reported the case of a Mexican youth who died of acute suffocation at the age of 20, who had been born and reared in Kansas City.

Hajek, in an excellent article in his recent handbook on the larynx, wisely suggested that the recent recognition of scleroma throughout practically the entire civilized world may be due not necessarily to its wider distribution but rather to an increased acquaintance with the disease, previous cases having escaped unnoticed. My second patient had previously consulted a rhinologist, but the condition had not been correctly diagnosed.

CONCLUSIONS

1. Scleroma, or rhinoscleroma, is no longer confined to a fairly definite locality in southeastern Europe but is fairly well distributed over the entire world.

2. The bacillus of Frisch is easily obtained in all cases in practically pure culture. This bacillus is very similar to the bacillus of Friedländer and of Abel. Although typical local lesions can be produced by injecting it into animals, it fails to satisfy the postulates of Koch, in that the disease itself cannot be reproduced in animals or in man.

3. The culture of the bacillus of Frisch is not necessary for the absolute diagnosis of the disease. Necessary, however, is the presence of the vacuolated lace or foam cells of Mikulicz and the hyaline bodies of Unna.

4. The mode of transmission or contagion is still unknown, and until this is discovered no definite means of combating the disease will be available.

5. At the present time roentgen radiation or radium in proper dosage offers the best hope of control or cure.

CARCINOMA OF THE LARYNX

A PLEA FOR MORE CONSERVATIVE SURGICAL PROCEDURES IN CERTAIN CASES

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LONDON, ENGLAND

Before active measures are employed on any patient suspected to be suffering from cancer of the larynx a specimen should be obtained, when possible, for microscopic confirmation and for guidance as to the best form of treatment to employ.

In considering the treatment of a laryngeal neoplasm it should be borne in mind that only a portion of the organ is directly responsible for the production of voice. There are regions intimately connected with the act of swallowing; these are the epiglottis, the aryepiglottic folds, the mucous membrane covering the posterior part of the cricoid ring and the muscles attached to it, really part of the pharynx. The pyriform fossa is in relationship externally to a small portion of the thyroid wing and is a recess of the pharynx rather than of the larynx. A growth confined to these regions can often be approached via the pharynx, and the operation entails a minimum of interference with the respiratory and vocal functions. It must be admitted that most growths of the pyriform fossa and all but early tumors of the retrocricoid portion of the pharynx require a laryngopharyngectomy for complete eradication. As I have already stated, however, in Toronto, it is questionable whether such a procedure is justifiable. I may again say that the term laryngectomy appears to me to be somewhat inaccurate, as it is impossible to remove the whole larynx without taking away a small portion, at any rate, of the pharynx. For a localized growth affecting the uppermost regions of the larynx or for a small tumor involving the retrocricoid portion of the pharynx, lateral pharyngotomy is the ideal method of approach, although a circumscribed growth on the epiglottis or aryepiglottic fold may sometimes be excised or destroyed by diathermy employed through the mouth.

A limited cancer of the vocal cord situated in the usual site about the middle, or just anterior to the middle, of the cord is ideal for the use of thyrofissure (a better term than laryngofissure, which would indicate splitting of the cricoid cartilage as well as the thyroid).

Read before the Section of Laryngology, Otology and Rhinology at the Joint Session of the American Medical Association and the Canadian Medical Association, Atlantic City, N. J., June 12, 1935.

It is rare to meet with a growth developing from the false cord or ventricle, but such a tumor, if superficial, might be treated by the same method. If the cord is movable and if at operation there is found to be little tendency to infiltration, it would seem advisable not to remove the overlying cartilage, as it acts as a barrier should recurrence take place, causing delay in involvement of the soft tissues of the neck and rendering complete extirpation, if later found to be necessary, easier to carry out. If the growth has crossed the middle line and has spread to the opposite cord or subglottic region or if it invades the region of the anterior commissure, I do not consider the case suitable for thyrotomy. So long, however, as it falls short of the arytenoid region a laryngectomy is generally unnecessary. It should be remembered that the nearer a growth confined to the vocal cord is to the commissure the greater is its proximity to the underlying cartilage. When the growth has extended to, or is confined to, the subglottic region but still occupies a position anterior to the transverse axis of the larynx, partial or anterior laryngectomy rather than complete extirpation is often sufficient. I shall shortly describe the methods I have employed in such cases. Operations on the lines I shall mention are favored by certain British and French laryngologists. The operation was developed, if not actually originated, in England by my predecessor at the London Hospital, Lambert Lack, and with sundry modifications I have found it admirably adapted, broadly speaking, for removal of cancer of the larynx situated anteriorly, a type of neoplasm which is unsuitable for thyrotomy because of bilateral involvement or subglottic extension. Unfortunately, cases suitable for this type of operation are not commonly met with. A similar procedure has been described by Hautant, Portmann and others, but to my mind the operation is too formal and not elastic enough to deal with the varying conditions which may be present in the larynx; indeed it resembles a hemilaryngectomy. The operation should be so planned as to remove adequately the diseased area, with a sufficient margin of healthy tissue and no more, not a particular portion of the larynx.

It will now be my endeavor to describe the operation in some detail. The preliminary preparations are exactly the same as for thyrofissure. Attention should be paid beforehand to the elimination, as far as possible, of buccal, pharyngeal and nasal sepsis. It is usually necessary for the patient to undergo preliminary dental treatment unless he is already edentulous, and it may be deemed advisable in some cases to remove all the teeth. The patient should enter the hospital or nursing home two or three days before the operation is to take place. If there is doubt that the diseased area can be removed by the surgical procedure I shall describe, consent should be obtained for complete extirpation. The best anesthetic is chloroform or gas and oxygen, the latter

having some distinct advantages. No preliminary medication is allowable; administration of morphine is highly dangerous. Anesthesia should never be deep. Some surgeons prefer to perform the operation with local anesthesia, either by the infiltration method or by blocking the nerves supplying the region. The patient should lie with his head well extended and not tilted to either side, or he may be placed in the Trendelenburg position. An efficient suction apparatus and an assistant who knows how to use it should always be at hand; such an apparatus proves indispensable in keeping the wound dry and so preventing any blood or secretions from being drawn into the lower air passages. If

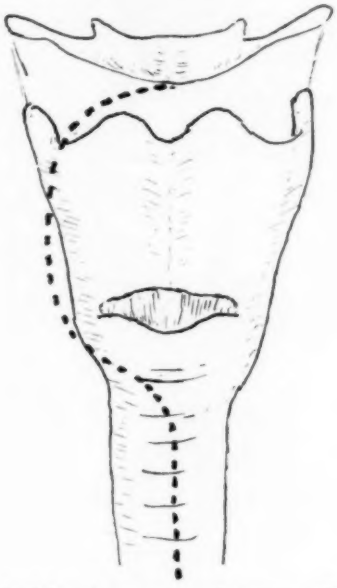

Fig. 1.—Preliminary incision in a case of cancer affecting mainly the right vocal cord. All the drawings are semidiagrammatic.

the operation is properly conducted scarcely a drop of blood should enter the trachea.

I originally made use of a median incision, but on account of the possibility of the formation of a fistula necessitating a subsequent plastic operation a flap is now employed. The incision which gives an adequate approach and which allows speedy and permanent covering of the wound in the larynx is fashioned in the form of a mark of interrogation, if the disease mainly occupies the left side, and in the form of a reverse interrogation mark if it occupies the right side. This incision allows of a flap of skin being turned aside from the larynx while the lower vertical portion is employed for the tracheotomy. By carrying the upper limb as a horizontal extension to the left or the right, sufficient

room can be obtained to expose the whole larynx when necessary. The transverse part of the incision should correspond in level to the lower border of the hyoid bone; the limit of the outward curve should reach as far as the posterior border of the thyroid cartilage at about the center of the border. The descending limit of the curve reaches the middle line at the lower border of the cricoid cartilage and is then extended vertically downward as far as the suprasternal notch. The skin is reflected, and all bleeding points are secured.

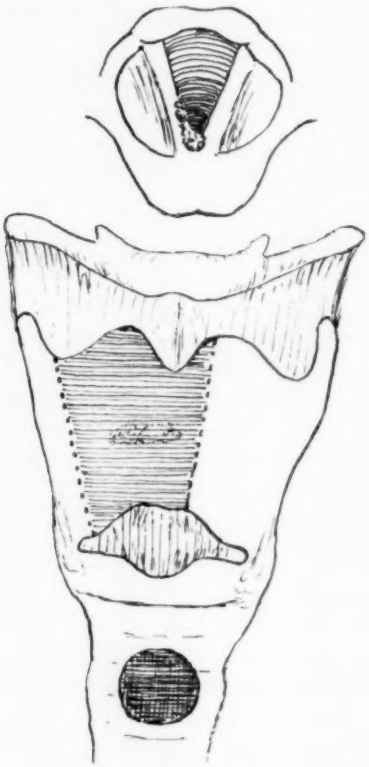

Fig. 2.—The extent of cartilage removed in a growth spreading from the right cord to the left across the anterior commissure.

The next step depends considerably on the extent of the tumor. This particular procedure has been decided on because the disease has crossed the middle line anteriorily, is mainly a growth of the anterior commissure or has extended into the subglottic region. The growth, moreover, may be subglottic as well as bilateral, or it may have passed upward so as to implicate the ventricular band. A large part of one thyroid ala and a portion of the opposite ala must be removed. The prelaryngeal muscles on the side chiefly affected should be turned aside;

if they are merely retracted the surgeon is likely to be hampered by an inadequate view of the operative field. The muscles on the less affected side can be retracted. The whole of the thyroid cartilage on the side chiefly involved, with the exception of the posterior border and cornua, must be exposed, and as the growth has extended up to, or crossed, the anterior commissure, the anterior border of the thyroid and a portion of the opposite ala should be laid bare, the perichondrium or periosteum being carefully preserved. The central portion of the thyrohyoid membrane (conus elasticus) is exposed to view, a keen lookout being kept for any enlargement of the gland situated on this membrane,

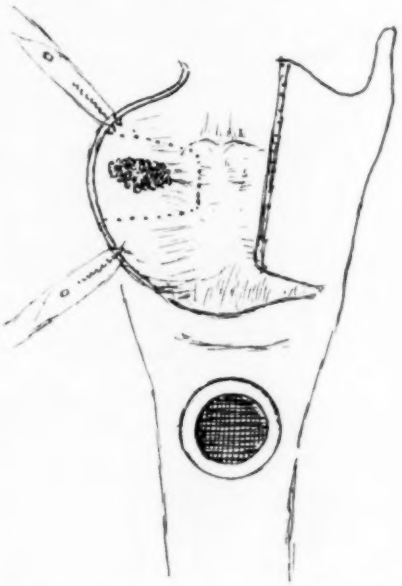

Fig. 3.—The cartilage has been removed and the mobilized soft tissues are pulled aside to expose the tumor.

which is sometimes involved in intrinsic cancer. If the gland is discovered it should be removed, preferably with the endothermy knife, and preserved for subsequent microscopic examination.

In order to describe better the further steps of the operation it will be convenient to imagine that it is being performed on a patient in whom the anterior half of the right cord is involved, the growth having crossed the middle line so as to implicate the anterior extremity only of the left cord. In such a case the whole of the anterior three fourths of the right thyroid ala and the anterior third of the left ala should be removed. The whole depth of the cartilage may be resected, or the extreme upper margin can be left. Complete removal is preferable, as when the larynx is opened a better exposure of the tumor is obtained,

and it is questionable if retention of the upper margin of the thyroid cartilage is of any importance in maintaining the laryngeal thoroughfare. Punch forceps are most useful in removing the cartilage, and it is best to begin from above. A small elevator is placed between the internal perichondrium and the thyroid ala, and separation is effected over a limited area. Cartilage is nibbled away in a downward direction, preceded always by further separation of the perichondrium and soft tissues. With a suitable pair of forceps sufficient cartilage or bone can be rapidly bitten away. If during this procedure any suspicious cartilage is encountered it should be kept for microscopic examination, and

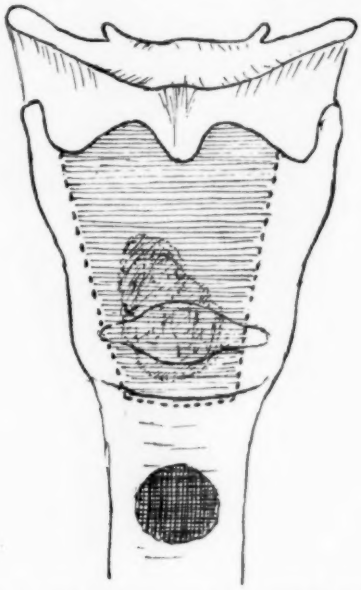

Fig. 4.—The amount of cartilage (thyroid and cricoid) which must be removed in an extensive growth, which has spread to the subglottic region.

an endothermy separator may with advantage be substituted for cold steel. It must be admitted that in certain cases in which before operation no suspicion of such a complication has been aroused, the thyroid cartilage is found to have been penetrated by the tumor. At an earlier stage the internal perichondrium and the cartilage lying in immediate contact may be involved, and the extension of the disease would not be recognized when the outer surface of the cartilage was examined. Such a condition reveals itself when the cartilage is removed during the procedure under consideration, and its recognition leads to the taking of early steps (diathermy or the actual cautery) to sterilize the region before considering the further plan of the operation. It may be stated here that strictly local involvement of the cartilage need not necessarily

indicate total extirpation of the larynx, but if it is extensively diseased there should be no hesitation in carrying out the major operation. Sufficient cartilage having been removed, the time has arrived to introduce a tracheotomy tube. It is necessary in nearly all cases to divide the isthmus of the thyroid. After division, a ligature should be tightly applied close to each cut surface. I am not certain that the preliminary injection of a solution of cocaine hydrochloride before opening the trachea is a sound procedure, as the cough which is induced on opening the windpipe helps to remove any secretion lying in the air passages.

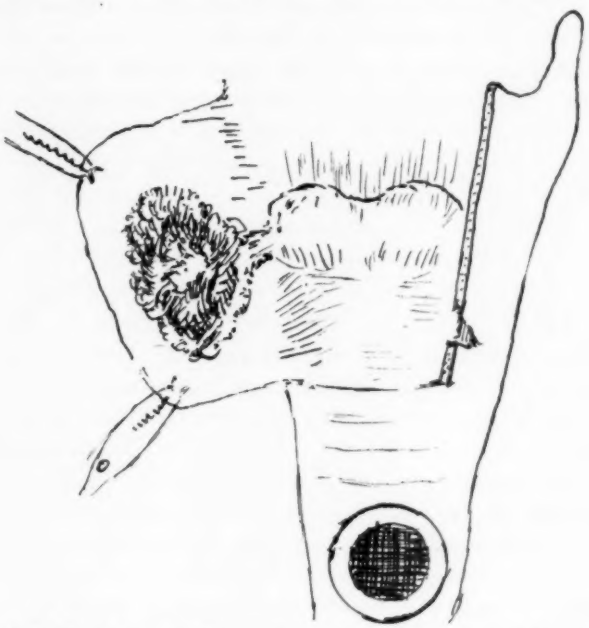

Fig. 5.—A further stage in the removal of a subglottic growth, as indicated in figure 4.

A disk, which includes portions of the second, third and fourth rings, should be cut from the anterior wall of the trachea. If the cancer is thought to be subglottic, the opening in the trachea should be made at a slightly lower level. At this stage some further information may be obtained by inserting a small laryngeal mirror into the tracheal opening. By using a frontal reflector a good view is obtained of the region of the anterior commissure, and a subglottic extension may be discovered. In the next step of the operation I insert through the tracheotomy opening a small sponge, with a thread attached, cut so as to plug effectively that portion of the respiratory tube corresponding to the lowest part of the larynx and the uppermost segment of the trachea. This prevents the descent of blood when the larynx is opened. The tracheotomy tube

is inserted, and through it the anesthetic is administered. The time has now arrived for opening into the cavity of the larynx. In many ways this is the most important step in the whole operation. It is essential that the entry be made through healthy tissue at a safe distance from the margin of the tumor. In effecting a thyrofissure the thyroid cartilage is divided in the middle line, the proximity of the section to the tumor depending entirely on the nearness of approach of the latter to the anterior commissure. In my imaginary patient the growth has spread to the anterior extremity of the left cord; therefore, the larynx should be entered well to the left side of the middle line. In some cases, however, it may be deemed advisable to open the cavity of the larynx at or near the level of the upper border of the thyroid cartilage. In this way the operator can more easily keep clear of the tumor. Another method is to have an assistant bulge out the healthy part of the larynx above the margin of the tumor with a rigid-angled instrument inserted through a directoscope. This instrument is palpated from the outside, and the incision can be made over it. An endothermy knife may be used in opening into the larynx and in carrying out the rest of the excision. It should certainly be employed when there is thought to be any risk of cutting into the tumor. It might be feasible, with an endothermy needle bent at a right angle, to open the larynx from within outward, employing a directoscope. There is no hemorrhage if this procedure is adopted, and therefore the incision can be made with great accuracy under direct vision. Once the larynx is opened, all that is necessary to obtain a general view of the interior is to apply traction to the cut edges of the wound, everting the mobilized tissues on which the tumor is situated when the latter can be viewed, as in thyrofissure *en face*.

Systematic excision can now be carried out, the surface and the edge of the tumor being kept in view all through the remainder of the operation. The exposure is quite as good as that obtained by thyrofissure, and in a suitable case there is no excuse for not excising an adequate amount of normal tissue all around the tumor. It is also extremely easy to ascertain the lower limits of the growth. If it is found to extend into the subglottic region it is best to resect the anterior part of the cricoid cartilage. When this has been accomplished the tumor can be traced downward and removed, a portion of the cricothyroid membrane being taken away, or a segment of the cricoid with the tumor lying on its posterior aspect may be removed in one piece. If the tumor occupies the anterior commissure, a slight modification of the procedure is all that is necessary. In certain cases, when the tumor cannot be removed completely, extirpation of the larynx may be avoided by treating any remaining portion of the diseased tissue by the insertion of radium.

The after-treatment does not differ in any respect from that employed after laryngofissure, except that it is generally advisable to leave the tracheotomy tube in position until complete healing has occurred. In a limited number of cases a permanent tube must be worn, but it is remarkable to note, so long as the mucous membrane covering the arytenoids, interarytenoid space and anterior aspect of the posterior ring of the cricoid cartilage remains, that the space, after cicatrization has taken place, is adequate for breathing purposes, and a tolerable voice may be retained.

ABSTRACT OF DISCUSSION

DR. H. B. ORTON, Newark, N. J.: It is true that a growth confined to the epiglottis and aryepiglottic folds is best approached by lateral pharyngotomy. But for a growth of the pyriform sinus or a postcricoid tumor in a late stage nothing short of a laryngopharyngectomy should be considered. These growths, however, are considered extrinsic cancer or epilaryngeal and hypopharyngeal. There is quite a difference between them and true cancer of the vocal cords.

I agree with Mr. Patterson that a true cancer of the vocal cords is the ideal condition for a thyrofissure, if biopsy shows it to be of grade 1 or 2. In cases in which I carry out a biopsy and almost remove the entire growth in the specimen, I immediately follow with a thyrofissure, and the patients so operated on are living, one for more than sixteen years. Yet I concede the good results of my colleagues, Jackson, Clerf, Buckley, New, Lewis, Tucker, St. Clair Thomson and others, in the use of thyrofissure on more extensive lesions. However, I agree heartily with Mr. Patterson that if the growth crosses the middle line and has spread to the opposite cord or is subglottic or invades the region of the anterior commissure, it is not suitable for thyrotomy. In such a case I perform a laryngectomy, with which I have had favorable results.

I have not tried the procedure that Mr. Patterson described, and I should like to ask his percentage of patients remaining well without recurrence after five years. He stated that it might be necessary in certain cases to remove the larynx later. In my opinion, extirpation of the larynx in the beginning would have been preferable.

Dr. New has reported that extension occurs well beyond the growth in the larynx with growths of grades 3 and 4. Biopsy and the grading of tumors are of great importance in planning treatment.

Mr. Patterson's description of the procedure is complete. It is a laryngotomy after removal of the anterior two thirds of the thyroid cartilage, with excision of the growth by means of diathermy. The anterior portion of the thyroid cartilage is removed, as compared to removal of the posterior portion in a lateral transthyroid pharyngotomy.

In England people have been educated to consult their physicians on account of hoarseness at a much earlier date than they do in this country, and for that reason I feel that English laryngologists see their patients at an early stage to perform this type of operation.

I should like to ask Mr. Patterson if his patients find it necessary to continue using the tracheotomy tube on account of complete stenosis following the operation.

The procedure is conceived to permit the passage of air into the patient's pharynx, and if that is possible, whether it is through a small opening from the

larynx or by swallowing air, as in a pharyngeal voice, the patient will have a tolerable voice.

I instruct my laryngectomized patients to learn the music "the return of the swallows by belch."

I do not like the term conservative operation for cancer. In my opinion, one cannot be conservative in its treatment.

Dr. L. H. Clerf, Philadelphia: I am heartily in accord with Mr. Patterson's views concerning the conservative surgical treatment of early carcinoma of the larynx. I would prefer to express it, however, as conservatism in the surgical treatment of carcinoma. Successful treatment is dependent on adequate removal of the carcinoma, together with a sufficient area of surrounding healthy tissue. If this can be accomplished without sacrificing the entire laryngeal air way, the patient will be far better off than he would be if laryngectomy were performed. With that in mind, I prefer to plan my procedure to suit the requirements in the individual case rather than to contemplate the removal of a certain portion of the larynx as constituting a particular operation.

The matter of anesthesia should be left to the choice of the operator. My preference is for local anesthesia. Tracheotomy preliminary to opening the larynx and placing a pack in the trachea from above, as practiced by Sir St. Clair Thomson, has proved satisfactory and is now used as a routine. I have no hesitancy in removing the ventricular band, the subglottic tissues including the cricothyroid membrane and even an arytenoid muscle if necessary. I do not practice extensive removal of cartilage. I believe that it acts as a satisfactory barrier in the event that recurrence takes place. If there is involvement of the cartilage, I believe that complete removal of the larynx is probably the safer procedure. It has been my practice to retain a laryngeal airway whenever possible, even if the patient must wear a tracheotomy cannula.

I have under my care a woman on whom I performed a thyrofissure during April 1930. Extensive removal was necessary, with the result that the airway was inadequate and she has required a tracheotomy cannula since. Recently I performed a laryngostomy to improve the air way, hoping that the cannula might soon be dispensed with. If this cannot be done, the patient still is better off economically with a small air way, which permits a laryngeal voice.

Mr. Norman Patterson, London England: I gather from Dr. Orton's statement that he thinks that I am not in favor of complete removal of the larynx. This is far from the truth, as in many cases laryngectomy is the only surgical procedure that holds out any hope of attaining a good result.

I have been discussing cases in which the distribution of the disease is such that some less radical operation is indicated. I am opposed to laryngectomy in the case of a small growth limited to one cord. I agree with Dr. Orton that when the disease has crossed the middle line and when it has become subglottic something more than a thyrotomy is required.

I have performed only a small number of operations by the method that I have described, as conditions are rarely suitable for such a procedure. I have available for a five year period operations on only seven cases. Three of the patients lived for more than five years, and four of them did not. Of the latter, two died, one after three and a half and one after one and a half years, but not of cancer. Therefore on patients who lived more than five years my statistics would show an incidence of about 42 per cent. Of the three patients who passed the five year period, one died of pneumonia after thirteen years. Six of the seven patients were able to dispense with a tracheotomy tube.

The question of grading is important, and cases for any modified operation must be carefully selected. When one is dealing with a growth that shows signs of a highly malignant character, a more extensive operation is necessary than when the disease is of a lower grade.

With regard to involvement of the cartilage, I cannot see the necessity of always removing the whole larynx if only the anterior portion is involved. Diathermy is only occasionally used in the operation, which is carried out with the usual cutting instruments.

Dr. Orton objects to the term conservative, but surely an ordinary thyrofissure is a conservative operation as opposed to complete extirpation of the larynx.

INFLUENCE OF HYGROSCOPIC AGENTS—GLYCERIN AND DI-ETHYLENE GLYCOL—ON IRRITATION FROM CIGARET SMOKE

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J. F. REINHARD, M.S.

AND

R. L. OSBORNE, B.S.

NEW YORK

In order to prevent the too rapid drying of cigaret tobacco, it is customary to add to it some moisture-holding substance. The hygroscopic agent generally used is glycerin, but there are others, among them di-ethylene glycol, which would serve the same purpose. The products of combustion in tobacco smoke are themselves somewhat irritating, and in adding to the tobacco any hygroscopic agent it is important to know whether its products of combustion play a part in the general effects.

From a study of the irritant properties of cigaret smoke on the rabbit's eye, Mulinos and Osborne [1] stated that glycerin used as a hygroscopic agent increases the irritant effects, whereas di-ethylene glycol does not. Suggested by this work, a comparison of the effects of cigarets treated with glycerin and those treated with di-ethylene glycol on a group of smokers has been made by Flinn.[2] The patients selected had been smokers for many years and consumed approximately twenty-eight cigarets a day, glycerin being the hygroscopic agent employed.

As a result of this steady smoking, 73 per cent of the group showed a congested throat and larynx; 66 per cent had coughs, and 7 per cent, an irritation of the tongue. The cigarets treated with di-ethylene glycol were then substituted for the ones previously used through a period of from three to four weeks. At this time the congestion of the throat had disappeared in 62 per cent, and there was considerable improvement in the others. The cough disappeared in 75 per cent of the cases with no change in the others. The condition of the tongue cleared up completely in each case.

From the Department of Pharmacology, New York University College of Medicine.

1. Mulinos, M. G., and Osborne, R. L.: Pharmacology of Inflammation: III. Influence of Hygroscopic Agents on Irritation from Cigarette Smoke, Proc. Soc. Exper. Biol. & Med. **32**:241, 1934.

2. Flinn, F. B.: Some Clinical Observations on the Influence of Certain Hygroscopic Agents in Cigarettes, Laryngoscope **45**:149, 1935.

While the results reported would be expected if the work of Mulinos and Osborne is accepted, Flinn himself pointed out the difficulty in eliminating the personal element in such a study and the lack of exactness in measuring grades of irritation. It seemed desirable then to repeat the work of Mulinos and Osborne, for a confirmation of this should establish the validity of Flinn's conclusions. The work reported here, then, was carried out as a check on the original experiments.

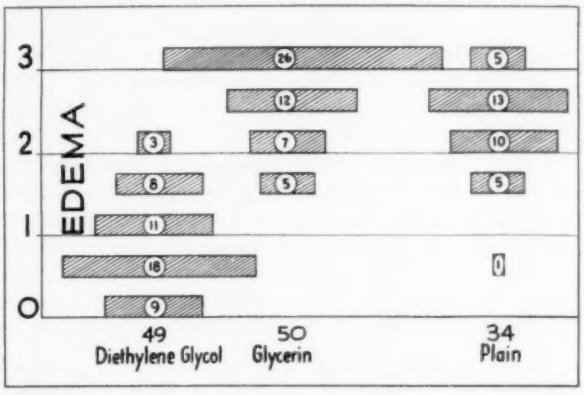

Chart 1.—Duration of irritation in minutes. The average duration is indicated in circles on the bar graphs; the extremes are indicated in parenthesis.

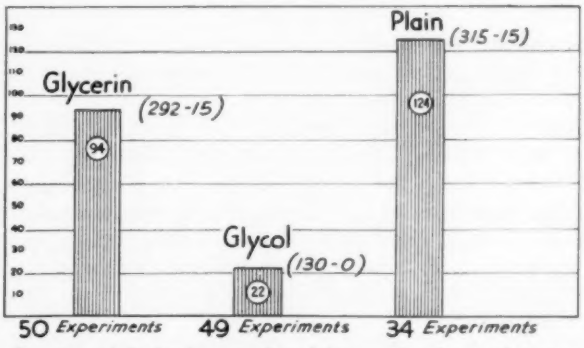

Chart 2.—Degree of irritation produced by smoke from cigarets treated with di-ethylene glycol and with glycerin and from plain cigarets.

The cigarets used were supplied by Philip Morris and Co. Ltd., Inc., and were of three groups: In the first group each cigaret contained 3.65 per cent glycerin as a hygroscopic agent; in the second group each contained 2.74 per cent di-ethylene glycol, and in the third no hygroscopic agent was used.

The smoking of the cigarets was carried out in the manner described in detail by Mulinos and Osborne. In principle this is as follows: The cigaret is placed in a holder which is connected to a filter pump giving intermittent suction; the cigaret is lighted, suction begun and the smoke drawn through a tube containing

a measured amount of physiologic solution of sodium chloride. This solution, containing the products of combustion of both the tobacco and the hygroscopic agent, is applied directly to the tissue selected for study of irritant effects. In this study, however, an electric pump was used for suction instead of a filter pump, as the water pressure in the laboratory was variable, and the electric pump gave a constant suction. Further, the water falling in the tipping bucket came from a bottle placed above the bucket and giving a constant flow to the bucket. Finally, instead of using a single smoking tube, two tipping buckets were used, so that two, or if desired three, groups of cigarets could be smoked simultaneously. The suction pressure and the water falling on the tipping bucket came through tubes having each two stopcocks, set in such a manner that after the first adjustment the pressure and water flow were constant throughout all the experiments. Through this arrangement, the smoking was simultaneous and identical for the three groups. Aside from these changes, the method of Mulinos and Osborne was followed exactly.

The test object for measuring the irritant effects was the rabbit's eye. The rabbits were selected with great care, and none with any evidence of existing irritation was used. As there seems to be a certain variability in reaction to irritants in different breeds of rabbits, practically all the experiments were done

Irritant Effects from Cigaret Tobacco

Hygroscopic Agent	Degree of Edema							Number of Experiments	Edema, Average
	None	½+	1+	1½+	2+	2½+	3+		
Glycerin	0	0	0	5	7	12	26	50	2.59
Di-ethylene glycol	9	18	11	8	3	0	0	49	0.77
None	0	1	0	5	10	13	5	34	2.22

on a breed of gray rabbits obtained from the Rockland Farms. As the irritation was in no case permanent, the same rabbits could be used for a number of tests at intervals which allowed complete recovery.

The solutions to be tested and which had been prepared simultaneously were applied to the lower conjunctival sac in a dose of 2 drops, an eye of one rabbit receiving the solution from one group, an eye of a second the solution from another group and the untreated eye serving as a normal standard. The readings of the degree of irritation were made at the following periods after the instillation: five, fifteen, thirty, sixty and one hundred and twenty minutes. After the last reading the eyes were examined when necessary until the time of complete recovery was determined.

The measurement of the degree of irritation was made in accordance with certain of the criteria described by Mulinos and Osborne.[3] The criterion which gives the most definite measurement is the presence and extent of edema. In cases of marked irritation the swelling is noted in the upper and lower lids and the bulbar conjunctiva and in the nictitating membrane. When the upper lid is retracted only a faint rim of white sclera is seen. The maximum degree of irritation, as evidenced by the edema, is reported as 3 plus; absence of edema, as 0, and gradations between these as ½, 1, 1½, 2 and 2½ plus. In making this grading

3. Mulinos, M. G., and Osborne, R. L.: Irritating Properties of Cigarette Smoke as Influenced by Hygroscopic Agents, New York State J. Med. **35**:590 (June 1) 1935.

it is to be understood that a considerable amount of preliminary practice is required. With training and experience, however, and with definite standards for comparison, the gradations of the degree of edema can be determined with rather remarkable accuracy. On the other hand, lack of experience and drawing conclusions from a general impression may lead to gross errors.

The second criterion is the redness from the injection of capillaries. This is seen most clearly in the bulbar conjunctiva. Different degrees of this have not been measured, but in the mildest irritation the hyperemia can be noted without edema being present.

Of other criteria, blepharospasm, when present, occurs immediately following the instillation. It is somewhat inconstant and does not lend itself to quantitative measurement. It may be pointed out, however, that if at the time of blepharospasm the upper lid is retracted, the conjunctiva of the lid may be pushed down, simulating edema. When the first reading is made five minutes after the instillation, the spasm has passed off and the pseudo-edema is absent. The rabbit's objection to the instillation, that is, its struggling after the first drop was applied, was noted but was too inconstant to seem important.

It should be pointed out that the measurement of the degree of irritation was made independently by two observers, each recording his own findings. Further, the solutions were given out by a third person, and the observers did not know the group to which the solution belonged until the readings were finished. In practically all instances there was agreement between the results reported by the two observers.

In this work, as in that of Mulinos and Osborne, each cigaret was smoked to within about 1 cm. of its end. As the objection might be raised that commonly the cigaret is discarded before it is smoked to this extent, some experiments were carried out with cigarets treated with glycerin and with glycol in which the smoking was discontinued when the last third of the cigaret was reached. No difference in the relative irritant properties of the two groups was found.

The results of the work are shown in the accompanying table and charts. From these it is seen that the agreement with those of Mulinos and Osborne is remarkably close. The correctness of their statement that the smoke from cigarets which have been made with di-ethylene glycol as the hygroscopic agent is less irritating than those with no hygroscopic agent and much less irritating than those made with glycerin is thus confirmed. Further, it may be stated that the duration of irritant effects from the cigarets treated with glycerin is much longer than that from those treated with the di-ethylene glycol. With the experimental basis thus established, the clinical results obtained by Flinn are what would be anticipated and can be accepted as correct.

GRANULOCYTIC ANGINA

REPORT OF THREE CASES WITH TWO FATALITIES

IRA FRANK, M.D.
CHICAGO

Within the last few years attention has been called to cases of aggravated sore throat associated with characteristic blood changes—a syndrome termed "granulocytic angina" and described as part of the toxic effects following the ingestion of certain drugs of the coal tar series used therapeutically or otherwise.

The drugs especially incriminated have been the barbiturates and aminopyrine. More recently, dinitrophenol has come into prominence.

Both physicians' prescriptions and open drugstore sales of drugs of the coal tar derivatives series have increased vastly during recent years, and the laity has become familiar with many of them. They have generally been considered as almost harmless when taken in controlled dosage by patients who show no evidence of idiosyncrasy. However, enough evidence has accumulated to cause strong suspicion that the continuous ingestion of drugs of this type may have definite toxic effects, at least in persons whose blood picture under such circumstances is especially characterized by marked granulocytopenia.

The matter is of great interest to laryngologists so far as the angina which accompanies the sore throat in many of the cases is concerned. In a case of granulocytopenia with throat symptoms the early diagnosis will depend on the patient's history and differential blood counts.

Before definitely discussing granulocytic angina, I should say a few words regarding granulocytopenia.[1] Granulocytopenia is known in the literature under such synonyms as "hypogranulocytosis," "agranulocytic anemia," "neutropenia," "malignant neutropenia," "agranulocytic leukopenia," "pernicious leukopenia" and "complete granulopenia." The condition is characterized by destruction or paralysis of the granulopoietic tissues, particularly of the bone marrow, and is expressed by marked diminution in the number of the leukocytes circulating in the blood, more especially of the granulocytes, even by their absence.

1. The term "agranulocytosis" is commonly used. However, I do not favor it because literally it means "not an increase of granulocytes." "Granulocytosis" means "an increase of granulocytes"—"agranulocytosis" means "not an increase of granulocytes," referring to a normal amount of granulocytes. In this paper the term "granulocytopenia" is used to designate the most important symptoms of this disease in preference to the contradictory term "agranulocytosis."

The changes in the bone marrow are considered by some to be of an aplastic nature, but Roberts and Kracke [2] have stated that there is unanimity that the essential change in granulocytopenia is a practically complete hypoplasia of the myelopoietic tissues. The diminution in the number of granulocytes may be due either to an intensive destruction of the cells or to a failure of development. The loss of leukocytes means a lessened resistance of the organism to invading germs. Other common lesions in granulocytopenia are ulcerations of the mucous membranes, especially in the mouth and throat.

Clinically, granulocytopenia is expressed especially by marked prostration, fever and rapid pulse, but the diagnosis can be definite only when the total leukocyte count is below 1,000 per cubic millimeter with a very low count or absence of granulocytes.

The exact cause of granulocytopenia is not known. The literature shows that the disease may be associated with any of several causes capable of producing leukopenia. Certain species of bacteria or rather their toxins are said to be among these causal agencies, which has led some to think that the underlying cause is a toxic leukocidin rather than a specific organism.

Some chemical agents, among them the coal tar derivatives mentioned, are well known to be able to produce leukopenia. In this article I am concerned principally with these chemical causal agents. Aminopyrine and its congeners are used as analgesics, and dinitrophenol has come into use for the reduction of obesity.

The whole subject of the relationship of drug therapy to granulocytopenia has been reviewed in an article just published by Kracke and Parker.[3]

A very large number of cases of granulocytopenia have been reported in the United States and Canada, about 80 per cent of which have occurred in women, chiefly those under 45 years of age. In the series of 103 instances collected by Jackson and Parker [4] only 20 occurred in males.

Kracke and Parker [3] said that granulocytopenia had been responsible for more than 1,500 deaths in the United States alone in the three year period ended in 1934. Of these, 172 apparently followed the use of drugs.

Regarding prognosis, Roberts and Kracke [2] said that "with the loss of immunity to bacteria, the loss of strength, the prostration of the

2. Roberts, S. R., and Kracke, R. R.: Further Studies on Granulopenia with Report of Twelve Cases, Ann. Int. Med. **8**:129 (Aug.) 1934.

3. Kracke, R. R., and Parker, F. P.: The Relationship of Drug Therapy to Agranulocytosis, J. A. M. A. **105**:960 (Sept. 21) 1935.

4. Jackson, H., and Parker, F.: Agranulocytosis: Its Etiology and Treatment, New England J. Med. **212**:137 (Jan. 24) 1935.

mental functions, the rising fever and the quick sepsis, death is inevitable unless a new crop of granulocytes quickly comes back into the blood stream." Without these, sepsis does its perfect work through blood stream infection, necrosis and gangrene. Plum [5] stated that in 128 cases of granulocytopenia due to the use of aminopyrine there were 70 fatalities. Madison and Squier [6] stated that in a group of 6 patients with granulocytopenia who continued to use drugs containing aminopyrine during their illness the mortality was 100 per cent, but among 8 patients who discontinued the use of the drug only 2 died.

The history of granulocytic angina down to 1931 has been given by Pepper.[7]

Granulocytic angina may be considered as secondary to and dependent on destruction of the leukocytes, especially the neutrophils. Kracke [8] and others have shown that the angina occurs after the onset of the granulocytopenia and is probably a result of lowered resistance in places easily subject to secondary invasion such as the mucous membrane of the throat. In the Jackson and Parker [4] series of 103 cases of granulocytopenia, ulcerated and gangrenous lesions, when present, were most common in the throat and pharynx. Staphylococcus, streptococcus and Bacillus proteus are most often found in cultures obtained from the throat. The lesions are found in the mouth, on the tonsillar surfaces, on the anterior pillars of the fauces or along the gingival margins. They are light grayish or white ulcerated patches, suggesting a peritonsillar abscess, and may extend to the uvula, tongue or pharyngeal membrane. Usually there is neither fluctuation nor pus.

Reznikoff [9] observed that in neutropenia the throat rapidly becomes diffusely involved but in a manner different from that in simple tonsillitis, in which the throat is bright red. The throat of the granulocytic patient appears purplish red; there are no bright red streaks. Later there is marked edema, and soon necrosis and sloughing occur. Usually the submaxillary lymph nodes are much enlarged.

Regarding the production of the throat lesions, Kracke [8] considered that some toxic agent such as the benzene chain contained in many coal tar derivatives might act as a depressant to the myelogenous portion of

5. Plum, P.: Experimentel og klinisk undersøgelse af amidopyrin som aarsag til agranulocytose: Seks nye dødeligt førløbende tilfaelde, Ugesk. f. læger **96**:916 (Aug. 28) 1934; Lancet **1**:14 (Jan. 5) 1935.

6. Madison, F. W., and Squier, T. L.: The Etiology of Primary Granulocytopenia (Agranulocytic Angina), J. A. M. A. **102**:175 (March 10) 1934.

7. Pepper, O. H.: The History of Agranulocytic Angina, J. A. M. A. **97**: 1100 (Oct. 10) 1931.

8. Kracke, R.: A Review of Granulocytopenia, J. Lab. & Clin. Med. **17**:993, 1932.

9. Reznikoff, P.: The Treatment of Agranulocytosis with Adenine Sulphate, J. Clin. Investigation **12**:45, 1933; Laryngoscope **44**:66 (Jan.) 1934.

the bone marrow, resulting in leukopenia and a consequent lowered resistance. There is constantly increasing evidence that acute fulminating granulopenia and probably the chronic type as well are caused for the most part by the administration of easily oxidizable benzene ring drugs. Although derivatives of the benzene ring have for a long time been known to be toxic to the bone marrow and have been considered to be the only chemical agents capable of producing a depression of the neutrophils, in recent years a number of other chemicals have been found to produce a similar effect. The latter, however, are not commonly used therapeutically.

Owing to the decreased resistance of the organism, infection may be facilitated anywhere, the mucous membranes of the mouth and throat being particularly susceptible. Under normal circumstances they are the habitat of innumerable fusiform and spirillar organisms and during a condition of leukopenia might easily become the site of intense infection.

Throat symptoms are generally a late manifestation of granulocytopenia due to a drug, a fact laryngologists should note. The requirements for a diagnosis of granulocytopenia with angina are simple; namely, a differential blood count, the clinical findings in the throat and the patient's history—especially regarding the ingestion of drugs belonging to the coal tar series.

Aplastic (panmyelophthisis) anemia and aleukemic leukemia must be differentiated from granulocytopenia. In the former the number of red corpuscles is markedly diminished, as is the number of platelets, in addition to the number of white blood corpuscles. Petechial hemorrhages are frequent. In typical cases of granulocytopenia the red blood count is practically normal and hemorrhages are absent. In instances of aleukemic leukemia as a rule the young forms of white cells are, occasionally at least, encountered in the differential counts. The enlargement of the liver and spleen in addition to aleukemic infiltration in other organs aids in the differential diagnosis.

CLINICAL REPORTS OF GRANULOCYTOPENIA AND GRANULOCYTIC ANGINA CAUSED BY DRUGS OF THE COAL TAR SERIES

In recent literature there are a number of clinical reports regarding granulocytopenia and granulocytic angina apparently caused by drugs of the coal tar derivatives series, aminopyrine, the barbiturates and dinitrophenol especially. Kracke and Parker [3] have given a chronological list of cases due to drugs (172 cases).

Aminopyrine (Pyramidon and Barbiturates).—Plum [5] stated in 1935 that since May 1933 no less than 128 cases had been reported in which granulocytopenia developed following therapeutic doses of

aminopyrine, and of these cases 70 were fatal. Plum observed 7 cases, of which 6 were fatal. Jackson [10] studied 27 cases of typical granulocytic angina, and found that in 26 per cent the disease followed the administration of aminopyrine or allied drugs. In another 30 per cent, despite the fact that such drugs were taken in considerable quantities, no causal relation could be established between these drugs and the disease. Hoffman, Butt and Hickey [11] had 14 cases of neutropenia following the use of aminopyrine, 13 of which ended fatally. Holten, Nielsen and Transbol [12] reported 6 cases of granulocytopenia following the administration of aminopyrine. Randall [13] reported severe granulocytopenia without throat symptoms following the use of barbiturates and aminopyrine. Watkins [14] reported 32 cases of granulocytopenia from the Mayo Clinic; 13 of the patients had been taking aminopyrine and 11, drugs of the barbiturate class.

The fatal case of this type which I observed had the following history:

CASE 1.—E. H., a woman aged 64, was seen at her home on March 20, 1933, because of sore throat and extreme exhaustion. Examination of the throat showed a small ulcer of the left tonsil covered with a grayish membrane, smears of which disclosed spirilla and fusiform bacilli—no pus cells. Because of these observations she was treated for Vincent's angina during the next few days, but since no improvement was apparent a leukocyte count was made, which showed only 1,200 cells. The blood count and differential count confirmed the diagnosis of granulocytopenia, and she was sent to the Michael Reese Hospital. A complete examination of the blood at 3 o'clock that afternoon showed: erythrocytes, 4,650,000; hemoglobin, 77 per cent; leukocytes, 1,100; neutrophils, 7 per cent; eosinophils, 0; basophils, 0; lymphocytes, 72 per cent; monocytes, 20 per cent. On admission the temperature was 103.4 F.; the pulse rate, 88; the respiratory rate, 26. Pentnucleotide, 10 cc., was given subcutaneously and daily thereafter for ten days. In addition she was given a transfusion of 400 cc. of blood by the direct syringe method. There was no immediate reaction. This was repeated daily for six days.

On March 27 the patient had considerable difficulty in swallowing.

On March 30 a blood count showed leukocytes 3,700 and erythrocytes 7,060,000.

On April 2 the difficulty in swallowing had increased, and marked edema of the larynx and some dyspnea were present.

On April 4 examination of the throat smears still showed fusiform bacilli and spirilla as the predominant organisms, with some short streptococci and a few

10. Jackson, H.: Am. J. M. Sc. **188**:482 (Oct.) 1934.

11. Hoffman, A. M.; Butt, E. M., and Hickey, N. G.: Neutropenia Following Amidopyrine, J. A. M. A. **102**:1213 (April 14) 1934.

12. Holten, C.: Nielsen, H. E., and Transbol, K.: Case of Agranulocytosis After Aminopyrine Therapy, Ugesk. f. læger **96**:245 (March 1) 1934.

13. Randall, C. L.: Severe Granulopenia Following the Use of Barbiturates and Amidopyrine, J. A. M. A. **102**:1137 (April 7) 1934.

14. Watkins, C. H.: The Possible Rôle of Barbiturates and Amidopyrine in the Causation of the Leukopenic State, Proc. Staff Meet., Mayo Clin. **8**:713 (Nov. 22) 1933.

degenerated pus cells. The ulcer on the left tonsil continued to increase in size and depth daily and was covered by a foul-smelling slough, the removal of which exposed the fascia beneath. Laryngeal examination showed moderate edema of the epiglottis.

On April 6, because of increasing dyspnea and cyanosis, tracheotomy was performed under local anesthesia, with complete relief. She was examined at 8:30 o'clock the following evening and was apparently doing satisfactorily. At 10:35 p. m., while asleep, she had a tremendous hemorrhage and died of exsanguination within a few minutes.

Permission for autopsy was refused.

The variations in the blood picture are shown in table 1.

This case is reported because of the severe complications and the unusual cause of death—erosion and rupture of the wall of the common carotid artery or of one of its larger branches. The family reluctantly admitted that the patient was in the habit of taking allonal for insomnia and pyramidon for headache. With this history and no other etiologic factors to be elicited, one must assume that granulocytic angina may be due to ingestion of a drug. It was impossible to determine the total quantity of the drugs ingested.

In their review Kracke and Parker stated that aminopyrine, either alone or in combination with one of the barbiturates, is most frequently found as the etiologic factor. Aminopyrine may be included in the formulas of many preparations put out under other commercial names.

Dinitrophenol (Nitrated Naphthol).—This chemical was used extensively in connection with the manufacture of munitions during the World War, and it was then observed to have some toxic effects on workers engaged in handling it, although there were apparently no characteristic lesions. Dinitrophenol bears a close relation to benzene in its chemical structure, its profound effects on cellular metabolism and its hepatic and renal toxicity. Its outstanding toxic effects are hyperthermia, profuse sweating, angioneurotic edema, jaundice and renal damage.

In July 1933 Cutting, Mehrtens and Tainter [15] stressed the use of dinitrophenol as a metabolic stimulant and proposed its controlled clinical use in the treatment of obesity. They gave therapeutically from 3 to 5 mg. per kilogram of weight daily with no observed ill effects. This is generally accepted as the safe therapeutic dose.

In September 1933 Anderson, Reed and Emerson [16] reported having encountered 1 case of "serious" toxicity in a series of 14 patients treated with dinitrophenol. There were no special throat symptoms.

15. Cutting, W. C.; Mehrtens, H. G., and Tainter, M. L.: Actions and Uses of Dinitrophenol, J. A. M. A. **101**:193 (July 15) 1933.

16. Anderson, H. H.; Reed, A. C., and Emerson, G. A.: Toxicity of Dinitrophenol, J. A. M. A. **101**:1053 (Sept. 30) 1933.

TABLE 1.—*Variations in the Blood Picture in Case 1*

Date	Time of Count	Hemoglobin, per Cent	Erythrocytes	Leukocytes	Neutrophils, per Cent	Lymphocytes, per Cent	Monocytes, per Cent	Immature Leukocytes, per Cent	Transitionals, per Cent	Basophils, per Cent	Metamyelocytes, per Cent	Myelocytes, per Cent	Myeloblasts, per Cent	Band Forms, per Cent	Segments, per Cent	Türk's Irritation Leukocytes, per Cent	Mature Forms, per Cent
3/23/33	3:00 p.m.	77	4,650,000	1,200	8	72	20	..	..	..	..	..	..	..	..	..	..
3/23/33	9:45 p.m.	..	.....	1,100	..	..	..	..	..	..	..	..	..	..	..	..	..
3/24/33	9:00 a.m.	..	.....	2,000	10	85	5	2	..	..	..	..	..	..	..	..	..
3/24/33	9:00 p.m.	..	.....	1,000	5	..	..	..	..	..	..	..	..	..	..	..	..
3/25/33	9:00 a.m.	..	4,190,000	1,650	8	90	..	2	..	..	..	..	..	..	..	..	..
3/25/33	9:00 p.m.	..	.....	1,900	..	..	..	..	..	..	..	..	..	..	..	..	..
3/26/33	11:00 a.m.	..	.....	1,600	..	..	..	..	..	..	..	..	..	..	..	..	..
3/26/33	4:30 p.m.	..	.....	1,800	12	84	4	..	..	..	..	..	..	..	..	..	..
3/27/33	7:30 a.m.	..	.....	1,600	16	42	..	..	4	4	20	8	6	..	..	..	..
3/27/33	p.m.	85	4,850,000	2,000	..	33	38	..	..	3	2	..	..	13	11	..	..
3/28/33	a.m.	..	.....	2,700	..	24	28	6	..	..	6	..	..	32	2	2	..
3/28/33	p.m.	90	5,690,000	2,100	..	29	29	..	..	1	4	1	..	27	7	2	..
3/29/33	a.m.	..	.....	2,500	..	50	15	..	..	..	13	..	..	17	..	..	5
3/29/33	p.m.	104	6,840,000	3,300	..	32	21	..	..	3	3	..	..	25	..	..	16
3/30/33	a.m.	..	.....	3,000	..	45	20	..	..	1	1	..	..	20	..	..	13
3/30/33	p.m.	110	7,060,000	3,700	..	34	24	..	..	..	..	1	..	21	..	..	20
3/31/33	a.m.	..	.....	2,800	..	50	20	..	..	..	15	..	..	15	..	..	..
3/31/33	p.m.	97	7,560,000	3,600	..	33	11	..	..	..	1	3	..	26	25	1	..
4/ 1/33	a.m.	90	.....	3,500	..	28	4	..	..	2	12	..	..	28	..	..	28
4/ 1/33	p.m.	..	.....	3,650	..	20	12	..	..	..	12	..	1	25	..	..	29
4/ 2/33	a.m.	..	.....	5,500	..	31	4	..	..	..	1	..	..	10	..	3	51
4/ 2/33	p.m.	..	.....	6,100	..	28	6	..	..	..	..	..	..	22	..	4	40
4/ 3/33	a.m.	..	.....	4,650	..	22	2	..	..	..	..	..	..	10	..	1	52
4/ 3/33	p.m.	..	.....	5,000	..	15	11	..	..	2	..	..	..	39	..	1	30
4/ 4/33	a.m.	..	.....	4,950	..	26	8	..	..	..	..	..	..	20	..	4	42
4/ 4/33	p.m.	..	.....	6,200	..	22	..	..	..	..	..	2	..	38	..	4	34
4/ 5/33	a.m.	..	.....	5,750	..	20	8	..	..	..	..	..	..	34	..	..	38
4/ 5/33	p.m.	..	.....	5,900	..	11	4	..	..	..	5	1	..	38	..	..	42
4/ 6/33	a.m.	..	.....	7,000	..	14	4	..	..	..	..	..	..	28	..	..	54
4/ 6/33	p.m.	..	.....	9,450	..	10	..	..	..	1	6	..	..	28	..	..	54
4/ 7/33	.....	..	.....	9,300	..	14	5	..	..	..	..	1	..	21	..	..	59

In October 1933 Geiger [17] reported a fatality from granulocytopenia following overdosage of dinitrophenol, without mention of throat symptoms. Silver [18] reported a personally observed fatal case with throat lesions.

In February 1934 Masserman and Goldschmidt [19] reported having observed 4 cases of toxicity with death in 1 case in a series of 18 patients treated with dinitrophenol. "Thermic dyspnea" was the outstanding symptom of toxicity observed by these reporters. No throat complications of note were mentioned.

In April 1934 Poole and Haining [20] reported a fatal case of dinitrophenol poisoning and gave complete autopsy reports. The throat symptoms were not included. Neither were throat symptoms referred to in the fatal case of dinitrophenol poisoning, evidently the result of overdosage, reported by Tainter and Wood [21] in April 1934.

These writers (as well as others) noticed a yellowish tinge in the skin and scleras of such patients. Hoffman, Butt and Hickey [11] reported a fatal case of dinitrophenol poisoning, and Jackson and Duvall [22] reported a nonfatal case in which the mucous membrane of the throat became affected on the fifth day and the skin and scleras took on a yellowish hue.

Beebe [23] and Geiger [24] have recently reported cases of dinitrophenol intoxication without throat symptoms. Several observers, for example, Davidson and Shapiro,[25] have reported the association of granulocytic neutropenia from the use of dinitrophenol, and Bohn [26] and others have observed the association with granulocytic angina.

It is evident from the foregoing summary that angina does not necessarily accompany the early stage of granulocytopenia caused by ingestion of dinitrophenol. In my own practice I have observed a case

17. Geiger, J. C.: A Death from Alpha-Dinitrophenol Poisoning, J. A. M. A. **101**:1333 (Oct. 21) 1933.

18. Silver, S.: A New Danger in Dinitrophenol Therapy: Agranulocytosis with Fatal Outcome, J. A. M. A. **103**:1058 (Oct. 6) 1934.

19. Masserman, I. H., and Goldschmidt, H.: Dinitrophenol: Its Therapeutic and Toxic Actions, J. A. M. A. **102**:523 (Feb. 17) 1934.

20. Poole, F. E., and Haining, R. B.: Sudden Death from Dinitrophenol Poisoning, J. A. M. A. **102**:1141 (April 7) 1934.

21. Tainter, M. L., and Wood, D. A.: Fatal Dinitrophenol Poisoning, J. A. M. A. **102**:1147 (April 7) 1934.

22. Jackson, H., and Duvall, A. L.: Report of a Case of Dinitrophenol Poisoning, J. A. M. A. **102**:1844 (June 2) 1934.

23. Beebe, N. L.: Colorado Med. **32**:30 (Jan.) 1935.

24. Geiger, J. C.: J. A. M. A. **104**:915 (March 16) 1935.

25. Davidson, E. N., and Shapiro, M.: Neutropenia Following Dinitrophenol, J. A. M. A. **103**:480 (Aug. 18) 1934.

26. Bohn, S. S.: Agranulocytic Angina Following Ingestion of Dinitrophenol, J. A. M. A. **103**:249 (July 28) 1934.

of granulocytopenia with angina following the use of dinitrophenol. The patient recovered under treatment. The history was as follows:

CASE 2.—Mrs. L., aged 28, was seen on Oct. 7, 1934 because of sore throat, dyspnea, pain in the right ear and extreme prostration. These symptoms began about one week previously and had persisted to the time the patient was seen. The temperature had ranged between 99 and 102 F.

Inspection of the throat showed a dirty, grayish-white membrane on the posterior wall of the pharynx, easily removable, which when removed did not leave a bleeding surface. A smear of material directly from the throat showed fusiform bacilli and spirilla. Culture showed hemolytic streptococci. A blood count made at her home showed: erythrocytes, 3,920,000; leukocytes, 750; hemoglobin, 80 per

TABLE 2.—*Variations in the Blood Picture in Case 2*

Date	Time of Count	Erythrocytes	Hemoglobin, per Cent	Leukocytes	Neutrophils, per Cent	Lymphocytes, per Cent	Monocytes, per Cent	Myelocytes, per Cent
10/ 7/34	.....	3,920,000	80	750	16	84	..	..
10/ 9/34	a.m.	4,140,000	80	1,100	18	82	..	..
	p.m.	.....	..	1,050	..	..	..	..
10/10/34	a.m.	.....	..	1,100	..	..	..	..
	p.m.	.....	..	950	..	..	..	..
10/11/34	a.m.	.....	..	2,050	12	88	..	..
	p.m.	.....	..	2,750	..	..	..	..
10/12/34	a.m.	.....	..	3,350	19	74	2	5
	p.m.	.....	..	3,750	..	..	..	..
10/13/34	a.m.	.....	..	4,300	18	68	12	2
	p.m.	.....	..	5,850	22	65	8	5
10/14/34	.....	.....	..	5,900	25	62	6	6
10/15/34	.....	.....	..	6,850	36	57	2	5
10/16/34	.....	.....	..	8,550	42	40	16	2
10/17/34	.....	.....	..	9,850	43	44	12	1
10/19/34	.....	.....	..	13,350	47	45	9	..
10/20/34	.....	.....	..	11,600	48	43	9	..
10/21/34	.....	.....	..	12,500	55	39	6	..
10/22/34	.....	.....	..	12,250	66	29	5	..
10/25/34	.....	.....	..	12,950	66	31	3	..

cent; polymorphonuclear neutrophils, 16 per cent, and many degenerated toxic forms. The patient was sent to the Michael Reese Hospital for further study and treatment. On entrance to the hospital the blood count showed: erythrocytes, 3,200,000; leukocytes, 900; polymorphonuclear neutrophils, 12 per cent; lymphocytes, 86 per cent; eosinophils, 2 per cent; hemoglobin, 60 per cent.

The patient said that she had been taking dinitrophenol, 1½ grains (0.096 Gm.), thyroid, 6 grains (0.38 Gm.), and pyramidon, 3 grains (0.19 Gm.), daily for obesity for about three months before the onset of the present condition and had lost 30 pounds (13.6 Kg.). She was admitted to the hospital at 8 p. m. At this time the temperature was 100.4 F.; the pulse rate, 116; the respiratory rate, 24 As soon as a suitable donor was obtained she was given a transfusion of 400 cc. of blood by the direct syringe method.

On October 9 pentnucleotide, 10 cc., was given intramuscularly morning and evening.

On October 10 she received another transfusion of 300 cc. of blood by the direct syringe method. Pentnucleotide, 10 cc., plus physiologic solution of sodium

chloride, 100 cc., was given intravenously at 10 a. m. At 11 a. m. 3 cc. of extract of liver was injected intramuscularly. In the afternoon 10 cc. of pentnucleotide was given intramuscularly.

On October 11 pentnucleotide, 10 cc., plus 100 cc. of physiologic solution of sodium chloride, was administered intravenously. Liver extract, 3 cc., was injected intramuscularly. In the afternoon pentnucleotide, 10 cc., was injected intramuscularly, and liver extract, 3 cc., intramuscularly.

On October 12 pentnucleotide, 10 cc., was given intramuscularly, and liver extract, 3 cc., intramuscularly.

On October 13 pentnucleotide, 10 cc., was injected intramuscularly and liver extract, 3 cc., intramuscularly.

The patient made a complete recovery.

There is no doubt but that this condition was due to the medication given previously for obesity. The stopping of the drugs and the transfusions combined with the medication were the factor in restoring this patient to normal health. The gradual improvement in the blood picture is seen in table 2.

The final blood count on discharge showed: erythrocytes, 3,800,000; leukocytes, 12,300; hemoglobin, 74 per cent; polymorphonuclear neutrophils, 58 per cent; lymphocytes, 49 per cent; eosinophils, 3 per cent.

In addition to the cases caused by drugs, I have seen one rapidly fatal case of granulocytic angina in which no history of taking drugs was obtainable. The history was as follows:

Case 3.—Mrs. F., aged 35, was seen at her home on March 22, 1935 because of a severe sore throat and difficulty in breathing. She said that she had been well until three days previously, when sore throat developed and the temperature rose to 103 F. She noticed at that time pain only on swallowing, with no difficulty in breathing. The next day she noticed swollen glands on both sides of the neck and had a cough which was productive of purulent material. A physician who was called took a culture, which was found to be negative for diphtheria. The next day the patient felt some chilliness, was hoarse and noticed some difficulty in breathing. She had never had diphtheria or scarlet fever nor had she recently been exposed to any infectious or contagious diseases. No evidence was obtained as to her habits respecting the ingestion of drugs. She appeared profoundly ill; the temperature was 104.2 F.; the pulse rate, 120, and the respiratory rate, 26. Examination of the throat showed both tonsils acutely swollen and covered by a dirty gray membrane; the cervical glands were swollen. Laryngoscopic examination revealed marked edema of the epiglottis and arytenoid cartilages. She was sent to the Michael Reese Hospital for a study of the blood and because of the possibility of an emergency tracheotomy. The blood showed: erythrocytes, 3,570,000; leukocytes, 500; hemoglobin, 65 per cent. A differential count showed only 10 cells, all lymphocytes, in the entire smear. The urine was normal. From the results of the study of the blood a diagnosis of granulocytopenia was evident.

At 8:30 p. m. she was given 10 cc. of pentnucleotide intramuscularly and the same evening a transfusion of 350 cc. of blood by the direct syringe. However, within a few hours she became cyanotic and rapidly became definitely comatose. Her respirations became more labored despite all efforts to stimulate them. She suddenly stopped breathing, and an intubation tube was inserted into the trachea. With the assistance of artificial respiration she then began to breathe, and after a few minutes her pulse responded somewhat. With this slight improvement

preparation was made to do a tracheotomy. While this preparation was in progress she stopped breathing, although the tube was functioning and in place. A tracheotomy was done immediately. The patient expired at 12:30 a. m. on March 23.

At autopsy the outstanding changes were as follows: Beginning near the base of the tongue and extending to the epiglottis and region of both tonsils, the mucosa presented a greenish-gray, ragged, necrotic, foul-smelling surface. The epiglottis itself was edematous and the aryepiglottic folds were markedly swollen, causing an almost complete occlusion of the entrance into the larynx. The true, and to a lesser degree the false, vocal cords were swollen and hyperemic. There were recent bilateral bronchopneumonia and cloudy swelling of the parenchymatous organs.

Microscopic examination of the pharynx revealed a ghostlike epithelium and a necrotic submucosa. Only a few lymphocytes and endothelial leukocytes were seen in the region of necrosis. Numerous micro-organisms were found in the necrotic portions. Sections of the bone marrow revealed areas of necrosis and a marked decrease in the number of white blood cells.

The anatomic diagnosis was: acute necrotizing pharyngitis; acute inflammation and edema of the larynx (granulocytic angina); recent bilateral bronchopneumonia; acute tracheobronchitis; acute esophagitis; cloudy swelling of the liver, acute splenic hyperplasia; dilatation of the heart; hyperemia of the liver and kidneys, and a recent tracheotomy wound.

TREATMENT OF GRANULOCYTIC ANGINA

As the angina is accepted as dependent on the granulocytopenia, the rational treatment is to remove the cause and to stimulate the hematopoietic system. The use of all coal tar drugs or others capable of producing leukopenia should be discontinued. Repeated blood transfusions are recommended. Pentnucleotide injected intramuscularly or intravenously or administered, well diluted with 100 cc. of physiologic solution of sodium chloride, by the continuous drip method offers at the present time one of the best methods of stimulating the bone marrow, and more satisfactory results have been reported from its use than following administration of any other remedy. The dose is usually from 10 to 22 cc., repeated twice daily. Burton [27] stated that the Nucleotide Committee of the Harvard Medical School analyzed 69 cases of granulocytic angina in which pentnucleotide was used in the treatment by 40 different physicians; 74 per cent of the patients recovered. A favorable response may be expected about the fifth day. The tables accompanying my case reports show the response of the blood to pentnucleotide and blood transfusions.

Intravenous injections of adenine sulfate boiled in saline solution have been recommended by Reznikoff.[9] Other remedies recommended for stimulating the blood-making organs are the roentgen rays and liver extract.

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27. Burton, F. A.: Recognition of Potential Agranulocytic Angina in Otolaryngology, Ann. Otol., Rhin. & Laryng. **43**:472 (June) 1934.

Under early treatment the mortality in cases of granulocytic angina has fallen to less than 30 per cent.

SUMMARY

Granulocytopenia may be caused by a number of agents, among which the drugs of the coal derivatives series, if used continuously, may be included.

A sore, ulcerated mouth and throat is a frequent result of granulocytopenia. The presence of throat symptoms with the characteristic blood picture of granulocytopenia verifies the diagnosis of granulocytic angina. If there is a history of the continuous use of drugs of the coal tar series, this should suggest a rational cause for the condition.

The literature on granulocytopenia and granulocytic angina apparently due to ingestion of coal tar drugs is reviewed, and the histories of two cases observed by me are given. The history of a third case, in which it was impossible to ascertain the patient's drug habits, is also given.

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NASOFRONTAL CONNECTIONS

A STUDY BASED ON ONE HUNDRED CONSECUTIVE DISSECTIONS

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In view of the large number of treatments and operative procedures used in the region beneath the middle nasal concha (middle turbinal), especially the ventral or anterior portion of the middle concha, an additional contribution to the morphology and relational anatomy of the nasofrontal field may not be amiss. At the suggestion of Dr. J. Parsons Schaeffer I undertook the dissection and study of one hundred consecutive adult specimens. In addition, fifteen late fetuses were dissected in aid of the embryologic interpretations. The results of these investigations I report herewith.

The anatomy of the region beneath the ventral and cephalic portion of the middle nasal concha is of great importance clinically, since the success of an ethmofrontal operation, whether intranasal or extranasal, is in direct proportion to the establishment of adequate intranasal drainage. It follows that one should have a clear conception of the variable anatomy of this region in order to obtain and maintain the best possible results. Likewise this knowledge is required in the interpretation of perplexing problems of diagnosis, of results of treatment and of untoward postoperative results.

EMBRYOLOGY

An understanding of the underlying embryonic development is required in order to comprehend the varied types of anterior ethmoidal fields and nasofrontal connections that are encountered in the dissecting room, daily practice and the operating room. In considering the adult anatomy of the nasofrontal region, one should have an understanding of its early and late fetal appearance. Evidence is seen in the embryo at the end of the third or early part of the fourth month of a beginning extension forward and upward of the middle nasal meatus. This early extension is the forerunner of the frontal recess and, strictly speaking, is the first step in the formation of the frontal sinus and certain of the anterior group of ethmoidal cells. For some time this ventral and cephalic portion (frontal recess) of the middle meatus remains even and unbroken. At first there is no evidence or suggestion of the pits,

From the Daniel Baugh Institute of Anatomy, Jefferson Medical College.

furrows and folds which later cause complexity of this portion of the middle meatus. Coronal and cross-sections of this region in a four month fetus show the lateral nasal plate of cartilage (part of the lateral nasal wall) thickened at certain points. These thickened cartilaginous areas are the forerunners or rudiments of the accessory frontal folds or accessory conchae, which in the late fetus configure the lateral wall of the frontal recess (recessus frontalis).

At this early period the thickened areas vary in number, are low and inconspicuous, and do not throw the mucous membrane into relief. In the late fetus, however, the thickened areas assume a more definite outline, and when term is reached this ventral and cephalic portion of the middle nasal meatus (recessus frontalis) is found to be constantly, though irregularly, developed. If at this stage the frontal recess is exposed by removing the ventral third of the middle nasal concha close to its marginal attachment, one finds, not a smooth, but an irregular mucosa. It is comparable, after a fashion, to waves with their intervening valleys. The waves represent the thickened cartilaginous areas in the four month fetus to which reference was made. They soon assume the rôle of accessory folds or accessory conchae. The intervening valleys may be designated frontal furrows or pits. These may be mere dimple-like depressions or short tubelike spaces. In this same region of the middle meatus, i. e., beneath the ventral or anterior half of the middle turbinal, is exposed to view the uncinate process, the ethmoidal infundibulum, the ethmoidal bulla and the suprabullar furrow. The uncinate process and the ethmoidal bulla should be considered as accessory folds or conchae of the middle meatus, analogs and homologs of the frontal conchae or folds; and the ethmoidal infundibulum and the suprabullar furrow, as accessory pits or furrows, analogs and homologs of the frontal pits or furrows.

Mention has already been made of the dimple-like depressions or short tubelike spaces in the fetus at term. These are well advanced and have begun the pneumatization of the ethmoid bone. It may even be possible at this stage to say which outpouching would eventually have formed the frontal sinus had the infant lived. Each furrow or pit is a potential paranasal or accessory sinus, enlarging to a greater or lesser degree by a positive growth which goes hand in hand with resorption of the related tissues and bones. Hormonal activity (anterior hypophysis) may be a factor. There is, however, no uniformity in the rate of development or the degree of differentiation in size and number of the frontal conchae or folds or of the pits or furrows. Some of the cells developing from this region remain diminutive and ethmoidal in topography, while one or more may grow to a considerable size and invade the frontal or other bones.

Before studying the various types of adult nasofrontal connections it will be helpful to review the different ways in which the frontal sinus or sinuses develop:

1. From one or more of the frontal anterior ethmoidal cells which have their genetic points in the frontal pits or furrows.

2. From a cell having its genetic point from the ethmoidal infundibulum, i. e., an infundibular anterior ethmoidal cell.

3. By direct cephalic extension of the ethmoidal infundibulum. In most cases this seems more apparent than real.

4. By direct extension of the whole frontal recess.

5. From a cell having its genetic point in the suprabullar furrow.

6. By combinations of the groups mentioned, resulting in more than one frontal sinus.

THE ATTACHMENT OF THE MIDDLE NASAL CONCHA

In carrying out this study of the anterior ethmoidal field and the nasofrontal connections, the middle nasal concha, or middle turbinal, was cut close to its marginal attachment on the lateral nasal wall, thus exposing to view the many important anatomic structures lying behind or lateral to the overhanging ventral half of the middle concha. All of the dissections illustrated in this paper were made in a like manner. It is suggested that the reader at this point examine the entire group of illustrations, noting the diversity of marginal attachments of the middle concha. For example, in figure 7 *B* the marginal attachment is very low on the lateral nasal wall. In direct contrast, in figure 8 *B* the marginal attachment of the middle concha is wide and can go no farther ventrosuperiorly. Somewhat similar in its ventrosuperior dimension to the middle concha shown in figure 8 *B* is that shown in figure 5 *B*, but in the latter the attachment is not wide anteroposteriorly. At great variance from all the others is the specimen represented in figure 8 *A* because of the unusal distance from the ventral to the dorsal end of the attachment of the middle concha. Occasionally one encounters the type portrayed in figure 4 *A*, in which the cut marginal line ventrally leads into the agger nasi region. In figure 6 *B*, the cephalic margin presents a baylike depression in an otherwise unbroken marginal line. These variations in the degree of fusion of the middle nasal concha in the region of the frontal recess with the ethmoidal bulla and the uncinate process affect the size and roominess of the frontal recess; indeed, in some cases the latter is largely wanting.

This short survey of the marginal attachment of the middle concha clearly indicates that there is no constant type of attached margin of this ethmoidal appendage. It also emphasizes the importance of fol-

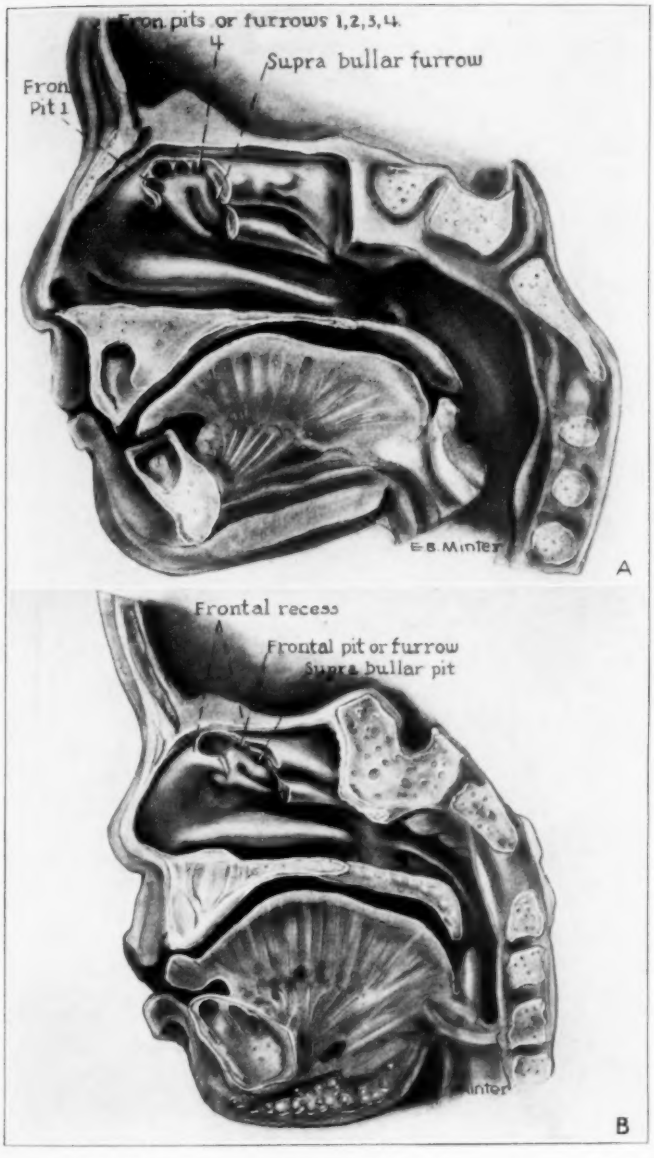

Fig. 1.—*A*, dissection of the frontal recess of a fetus at term, illustrating the early frontal pits or furrows, i. e., rudiments of anterior ethmoidal cells and potential rudiments of the frontal sinus. The most ventral of the frontal pits or furrows is referred to throughout this paper as pit 1, the next in order as pit 2, and so on. Note that the frontal pits or furrows and the ethmoidal infundibulum are not continuous channels. *B*, dissection of the frontal recess of a fetus at term. Note at this early date the tendency of the ethmoidal infundibulum (as indicated by the broken white lines on the frontal recess) to expand beneath or lateral to the frontal recess. If it were not for the presence of a frontal pit one could say that the frontal recess is extending to form the frontal sinus.

lowing the marginal line when operating, cutting cleanly whatever portion of the concha is to be removed. To do otherwise invites adhesions and defeats the operative aim of instituting or improving drainage of the ethmofrontal field in a case of suppuration. In a case of pressure, faulty enucleation might well result in failure to remove the causative factor.

1. FRONTAL SINUSES ARISING FROM FRONTAL ANTERIOR ETHMOIDAL CELLS

In 57 per cent of the one hundred consecutive dissections of this series, the frontal sinuses obviously arose from frontal pits or furrows

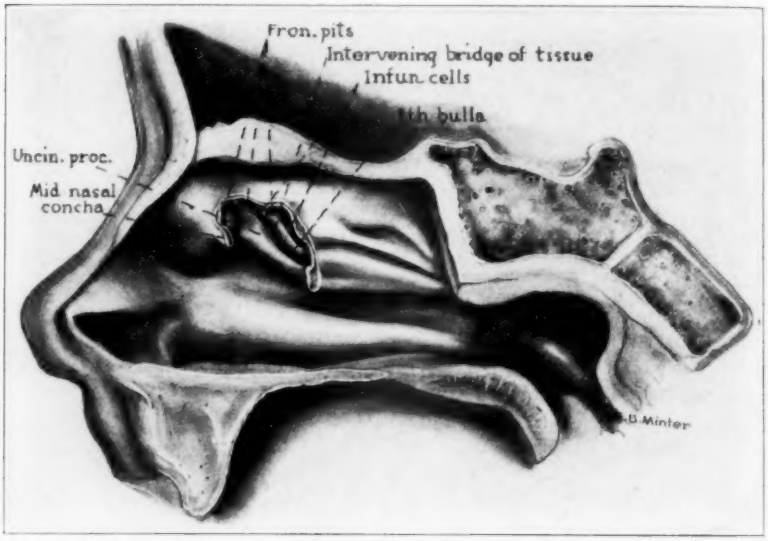

Fig. 2.—Dissection of the frontal recess of a fetus at term, illustrating the early infundibular anterior ethmoidal cells. Note the bridge of tissue between actively expanding infundibular cells. Frontal pit *2* is in alinement but not continuous with the ethmoidal infundibulum. If, during the developmental period, the intervening bridge of tissue should be resorbed and the cell in the ventral extremity of the ethmoidal infundibulum should become continuous with frontal pit *2*, it would be wrong to conclude that the frontal sinus had its origin in the ethmoidal infundibulum.

located in the frontal recess, pits which in reality were rudimentary frontal anterior ethmoidal cells. Figures illustrating this particular type of nasofrontal connection are 4, 5, 6 and *7 A*.

For purposes of orientation and contrast at the outset, the reader should compare figure 1 *A* (from a fetus) with figure 4 *A* (from an adult). It will be noted that in the fetal preparation there are four

distinct frontal pits or furrows in the frontal recess, whereas in the adult specimen there is evidence of four similar pits, two of which, although genetically ethmoidal, developed into frontal sinuses, while others developed into ethmoidal cells and remained ethmoidal in topography. In contrast, the adult preparation shown in figure 7 *B* gives no

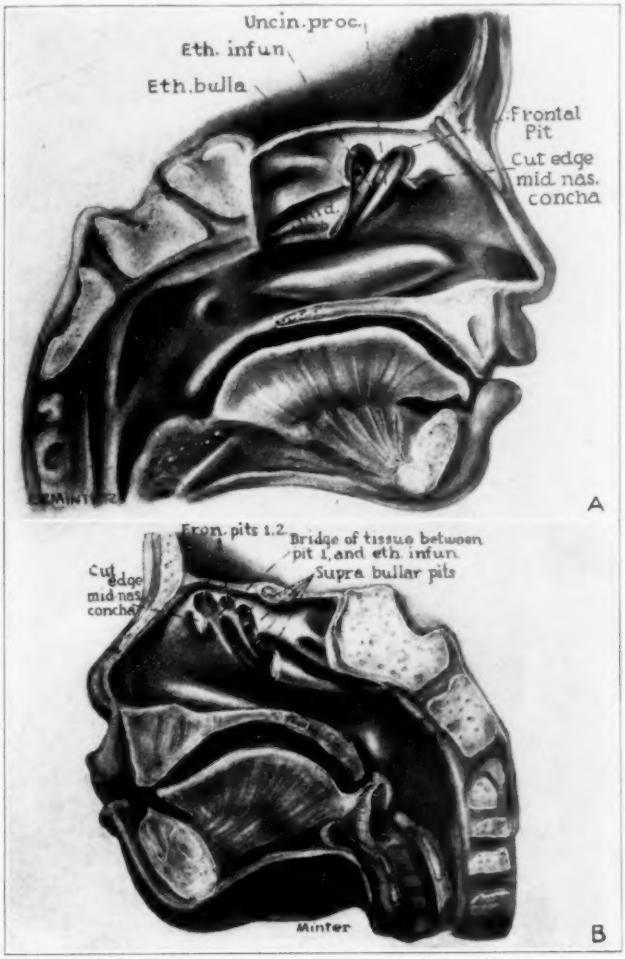

Fig. 3.—*A*, dissection from a fetus at term. Note the intimate relationship between the ventral extremity of the ethmoidal infundibulum and the frontal pit. Should the frontal sinus develop from the latter the adult relationship between the infundibulum and the sinus would be very intimate. Indeed, there might be direct continuity, allowing for further changes in development. *B*, dissection from a fetus at term. Note the slight barrier between pit 1 and the ethmoidal infundibulum. The adult picture would most likely present a nasofrontal connection directly continuous from the infundibulum to the frontal sinus.

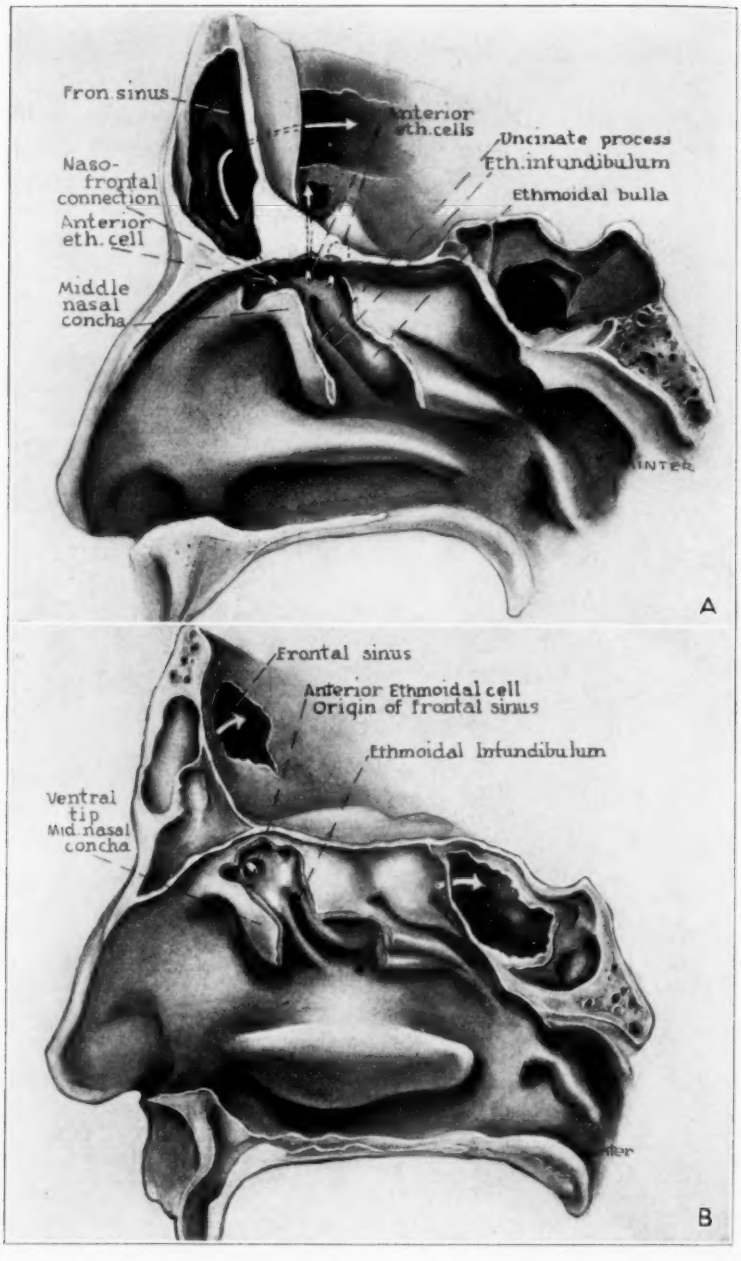

Fig. 4.—*A*, dissection from an adult. In all the dissections of this series the middle concha is cut close to its marginal attachment, thus exposing for study the frontal recess and the nasofrontal connections. Especially observe the evidence of four early frontal furrows and note that pit 1 grew ventralward into the agger nasi region. The nasofrontal connection extends from pit 2 to the frontal sinus and is not continuous with the ethmoidal infundibulum. *B*, dissection from an adult. Note the inactivity of all the frontal pits except pit 2. The broken white lines on the frontal recess indicate the blind ending of the ethmoidal infundibulum lateral to the frontal recess.

evidence of early frontal pits or rudimentary anterior ethmoidal cells in the frontal recess.

Should the frontal sinus develop from the first, or anterior one, of the frontal pits or furrows, it is obvious that the sinus would be more remotely related to the ethmoidal infundibulum than in certain other types. If, however, the frontal sinus should arise from a frontal pit lying in the same axis as the ethmoidal infundibulum, the relationship of the two would be intimate (fig. 5 *B*). An important observation in this group (fifty-seven dissections) concerns the adult position of the ethmoidal infundibulum and its relationship to the frontal recess. In almost every instance the ethmoidal infundibulum ends blindly lateral to the frontal recess (figs. 8 *B* and 9 *A* and *B*). Occasionally this blind and lateral evagination of the ethmoidal infundibulum continues frontalward and forms the frontal sinus, thus giving rise to another type of nasofrontal connection (figs. 7 *B* and 10 *A*). The last named type, however, will be discussed later as a separate group.

In view of the favor with which the ethmoidal infundibulum is looked on as an intranasal landmark, the frequency of its blind termination lateral to the frontal recess takes on added clinical significance. Of greater importance is the fact that in over 50 per cent of cases a frontal sound will not pass into the frontal sinus by merely following the ethmoidal infundibulum frontalward.

In tracing the origin of the frontal sinuses from frontal pits or furrows, it will prove helpful to examine dissections at and near term (figs. 1, 2 and 3). The number of pits in the frontal recess of a specimen at term varies from none to four, and of the latter each possesses the potentiality of becoming a frontal sinus. A comparison of figure 1 *A*, representing a dissection from a fetus at term, with figure 4 *A*, representing a dissection from an adult, will identify the homologous structures. If pit 1 in figure 1 should evaginate ventralward toward the agger nasi, pit 2 give origin to the frontal sinus, and pits 3 and 4 pneumatize the pars orbitalis of the frontal bone, the adult result would resemble the specimen illustrated in figure 4 *A*. The entire region lateral to the attached ventral end of the middle concha in the latter specimen is pneumatized by the ethmoidal infundibulum and infundibular cells. The attached ventral end of the middle concha which stands out so prominently in this dissection would need to be exenterated if free and easy drainage from the frontal sinus were desired.

In the dissection illustrated in figure 4 *B* the frontal sinus doubtless had its genesis in pit 2 of the frontal recess, and the ethmoidal infundibulum ends characteristically by pneumatizing the region lateral to the frontal recess. Unlike the condition found in the preceding dissection,

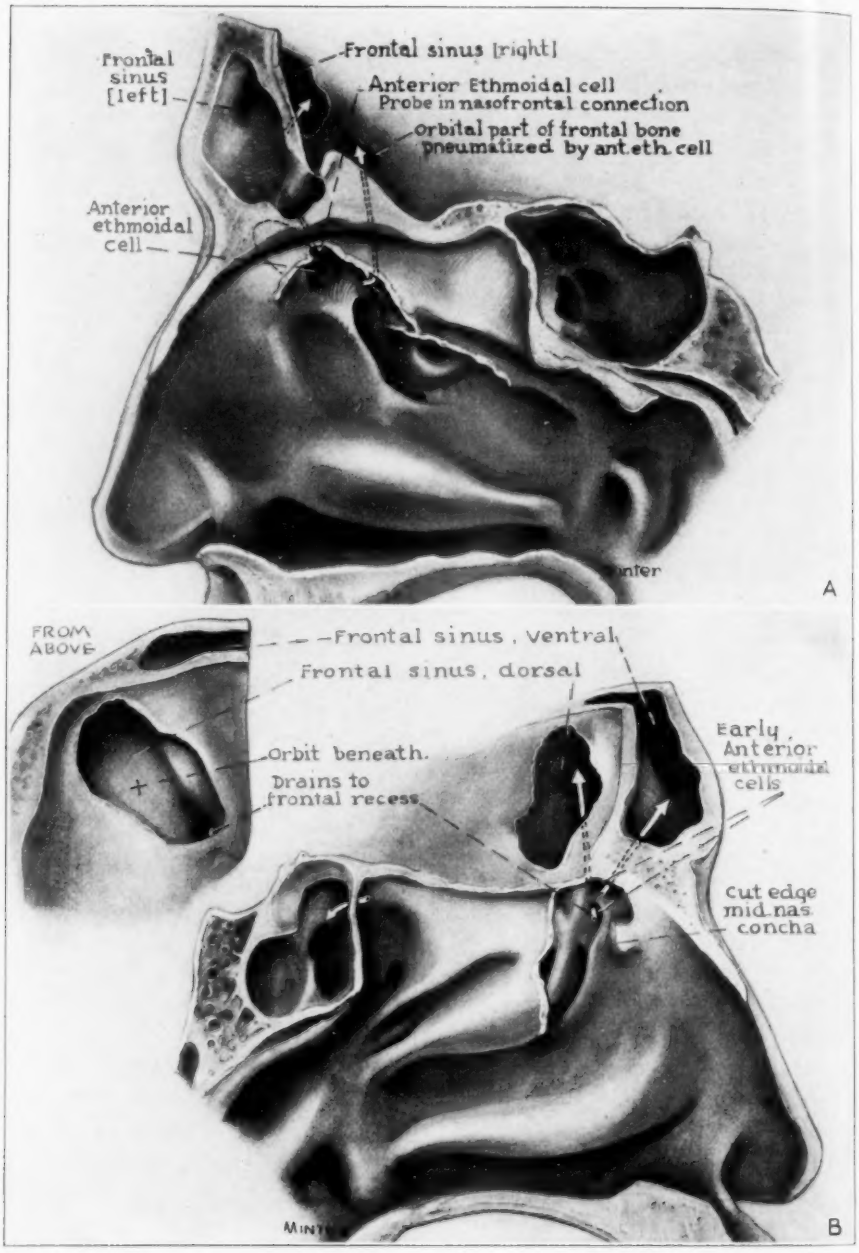

Fig. 5.—*A*, dissection of an adult frontal recess illustrating the manner in which the ethmoidal infundibulum expands ventral and cephalicward lateral to the frontal recess. The nasofrontal connection opens into the frontal recess. The pneumatization of the orbital part of the frontal bone is due to the evagination of a frontal pit far dorsal in position. *B*, dissection from an adult. Note the frontal sinus present in duplicate, the nasofrontal connection in each instance arising from a frontal pit in the frontal recess and lying in the same axis as the ethmoidal infundibulum.

i. e., figure 4 *A*, the second pit is the only one that grew beyond the immediate frontal recess region, pits 1, 3 and 4 remaining comparatively inactive.

In the specimen shown in figure 5 *A*, from an adult, the frontal sinus arose from pit 3. Pits 1 and 2 appear to have coalesced and pneumatized the frontal bone but slightly. In the majority of cases pit 2 is the one most likely to be found pneumatizing the vertical portion of the frontal bone. Frontal pits or furrows dorsal to the second pit are usually found evaginating into the ethmoid bone or variously beyond into the pars orbitalis of the frontal bone. If they pneumatize the vertical portion of the frontal bone, the likelihood of a tortuous nasofrontal connection becomes apparent.

2 AND 3. FRONTAL SINUSES ARISING FROM (1) INFUNDIBULAR ANTERIOR ETHMOIDAL CELLS AND (2) BY DIRECT EXTENSION FRONTALWARD OF THE ETHMOIDAL INFUNDIBULUM

The term "infundibular anterior ethmoidal cells" roughly represents the following:

(*a*) Cells that extend the ethmoidal infundibulum frontalward beneath or lateral to the frontal recess and there end blindly.

(*b*) Cells that instead of ending blindly continue to expand into the frontal bone, thus establishing a direct anatomic continuity with the frontal sinus.

(*c*) Cells that establish an apparent anatomic continuity with the frontal sinus either with or without the intermediary aid of a frontal pit or furrow. In this instance Schaeffer's descriptive term, "anatomic contiguity," would be more exact.

(*d*) Cells that expand ventralward and cephalicward beneath or deep to the free ventral border of the uncinate process, the attached end of the middle concha, and beyond into the agger nasi region. The last named class frequently pneumatize no farther than the region lateral to the attached ventral end of the middle concha, and less frequently extend to the agger nasi. This study of one hundred consecutive dissections leads me to believe that when the agger nasi is pneumatized the genetic factor is to be found in an infundibular anterior ethmoidal cell and less frequently in a frontal anterior ethmoidal cell.

(*a*) According to the material studied, there is a marked tendency for the infundibular anterior ethmoidal cells to evaginate frontalward lateral to the frontal recess and there end blindly. To a greater or lesser degree, this condition is found in the majority of dissections. The early tendency may be seen in the fetal dissection shown in figure 1 *B* (indicated by the broken white lines on the frontal recess). The other fetal dissections show similar tendencies. Adult types commonly

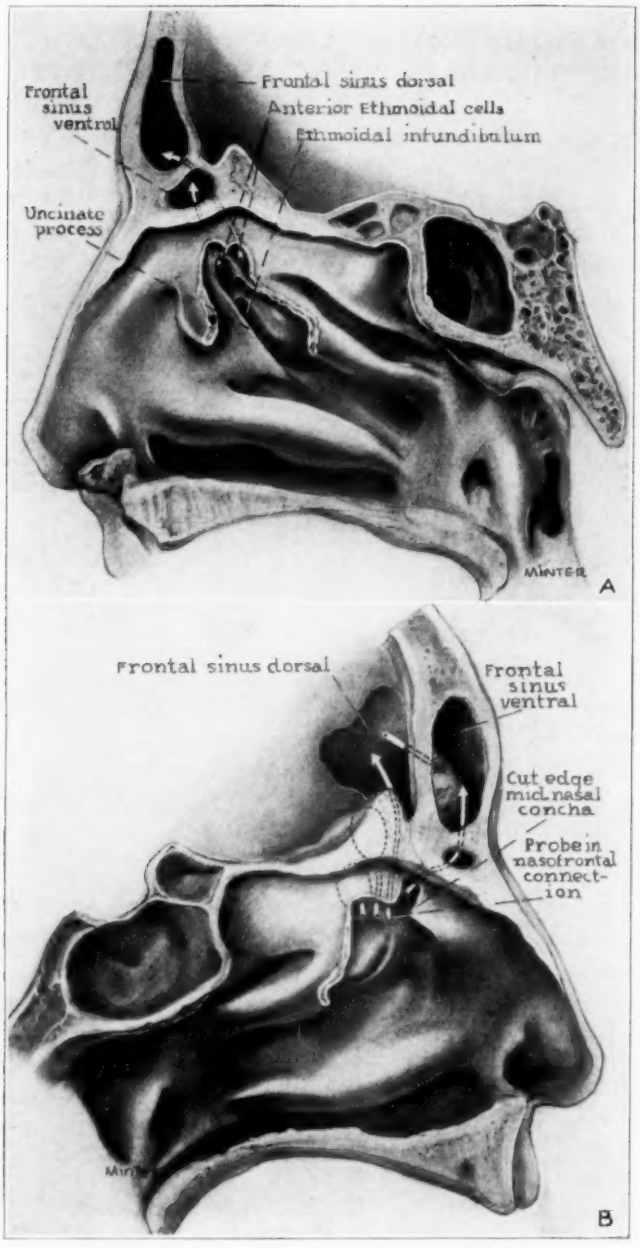

Fig. 6.—*A*, dissection from an adult. Note the multiple frontal sinuses and a tortuous nasofrontal connection. The connection to the smaller frontal sinus is easily entered, but that to the larger sinus offers a problem in angulation. *B*, dissection from an adult. Note the pairing of the frontal sinuses and the accompanying nasofrontal connections. The dorsal sinus has a small external opening in the frontal recess and would be easily missed on probing. Note the tortuosity of the nasofrontal connections and the irregular contour of the cut turbinal margin.

encountered and portraying clearly the condition mentioned are represented by figures 8 *B*, 9, 10 *B* and 11.

(*b*) In a relatively small number of dissections (4 per cent of this series), the infundibular anterior ethmoidal cells, instead of ending blindly lateral to the frontal recess, continue their expansion frontalward and pneumatize the vertical portion of the frontal bone. As a result, there is established a nasofrontal connection in direct anatomic continuity with the ethmoidal infundibulum. In each of these four cases, the region lateral to the attached ventral end of the middle concha is well pneumatized. Dissections illustrating these facts are represented by figures 7 *B* and 10 *A*. An interesting comparison may be made with the fetal dissection illustrated by figure 2, in which the early infundibular cells can be seen. The intervening bridge of tissue between the two infundibular cells may or may not be resorbed during adult growth.

(*c*) In a relatively large number of dissections (34 per cent of this series), the nasofrontal connection is contiguous with the ethmoidal infundibulum. An analysis of the fetal dissections shows the genetic cause for such contiguity to be due to infundibular cells, especially those located in the ventral extremity of the ethmoidal infundibulum (fig. 2). Another explanation may be ascribed to the junction of frontal pits with infundibular cells lying in the same axis (fig. 3*A* and *B*). In the latter case a frontal pit or furrow is in direct alinement with the ethmoidal infundibulum, a narrow bridge of tissue alone intervening. Should the frontal sinus develop from the frontal pit in question and the bridge of tissue be partially resorbed, the frontal sinus or the nasofrontal connection would simulate a direct anatomic continuity with the ethmoidal infundibulum (fig. 8 *A*). A careful examination, however, of the frontal end of the ethmoidal infundibulum in such cases indicates that the frontal sinus did not develop from the infundibulum. (Compare figures 3 *A* and 8 *A*.)

In some cases, infundibular cells located in the ventral extremity of the ethmoidal infundibulum, without the intermediary aid of a frontal pit or furrow, extend to form the frontal sinus. (Compare figures 2 and 12 *A*.)

(*d*) Commonly the ethmoidal infundibulum and infundibular anterior ethmoidal cells expand ventralward and cephalicward beneath or deep to the free ventral border of the uncinate process. This evagination extends ventralward beneath or deep to the attached anterior end of the middle concha with surprising regularity and may extend sufficiently far ventralward to pneumatize the agger nasi. This study of one hundred dissections demonstrates that when the agger nasi is pneumatized it is usually due to an infundibular anterior ethmoidal cell and rarely to a frontal anterior ethmoidal cell (figs. 5 *A*, 8 *B*, 9 *B* and 11).

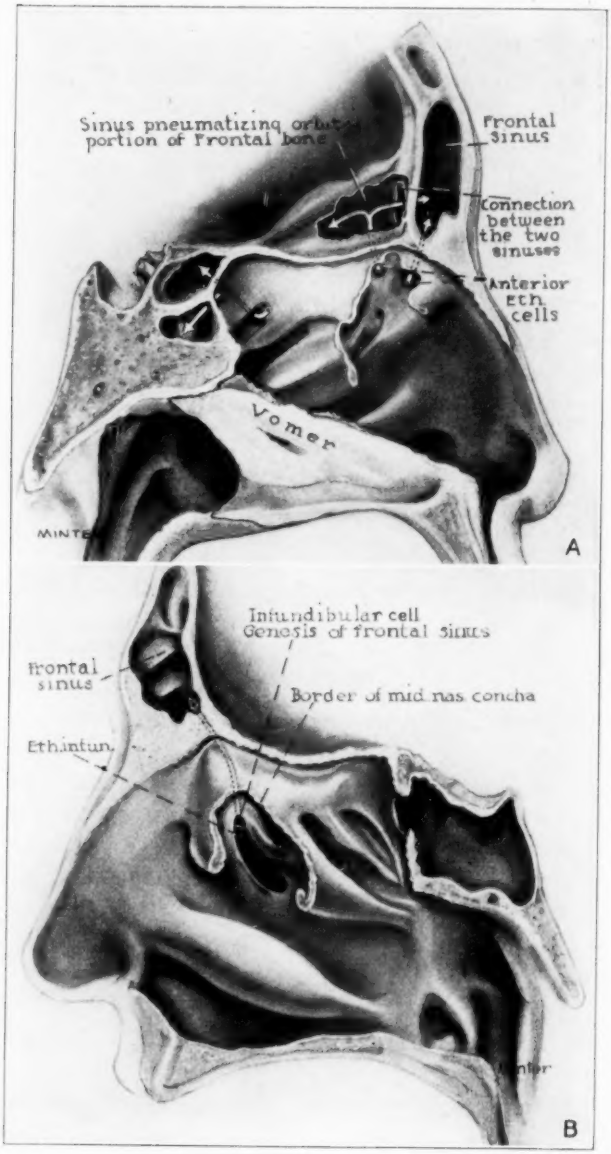

Fig. 7.—*A*, dissection from an adult. The frontal sinus had its origin from frontal pit 1 and is not continuous with the ethmoidal infundibulum. Note the natural opening between the frontal sinus in the vertical portion and that in the horizontal portion. *B*, dissection from an adult. Note that the frontal sinus and the ethmoidal infundibulum are in direct anatomic continuity. There is no evidence in the frontal recess that frontal pits or furrows were ever present. The attachment of the middle concha is very low on the lateral nasal wall in the region of the frontal recess.

4. FRONTAL SINUS ARISING FROM DIRECT EXTENSION OF THE FRONTAL RECESS

In only three of the one hundred dissections did it appear that the frontal sinus arose by direct extension of the entire frontal recess (fig. 10*B*). This type of frontal sinus can and should be differentiated from those having their genesis in one or more frontal pits located in the frontal recess. An extension of the frontal recess not forming the frontal sinus is portrayed in figures 9*A* and 11. In none of the fifteen dissections at or near term was there a clearcut indication of an expansion of the entire frontal recess. The nearest approach is found in figure 1*B*. This finding coupled with the 3 findings in the dissections in adults suggests that the condition is relatively infrequent. When it occurs, however, one may expect a large and roomy connection between the frontal sinus and the middle meatus, because there is no way for the frontal recess to be constricted or to be impinged on in the absence of frontal anterior ethmoidal cells. At times, however, on account of overgrowing or more rapidly developing infundibular cells there result a distortion and a constriction of the frontal recess. Clinically, then, in the presence of unusually large infundibular cells, some distortion and narrowing of the frontal recess may be expected. On the other hand, if the frontal sinus is formed by direct extension of the entire frontal recess, free and easy intranasal entrance to the sinus is expected.

5. FRONTAL SINUS ARISING FROM A CELL ORIGINATING IN THE SUPRABULLAR FURROW

In 2 per cent of the one hundred consecutive dissections of this series, the frontal sinus had its origin in the suprabullar region. This has resulted in a difficult intranasal approach to the adult sinus. Occurring so rarely, it is an approach to the frontal sinus not anticipated, and even if it were, the angulation accentuated by the projecting ethmoidal bulla (unless it were exenterated) would cause considerable difficulty when entrance is attempted.

Dissection (fig. 8*B*) demonstrated clearly that the angle of approach to the frontal sinus increases as one passes from pit 1 in the frontal recess to the pits farther dorsalward. In two of the illustrations accompanying this group of dissections (figs. 8*B* and 11) the tortuosity of the nasofrontal connections resulting from their point of origin being far dorsal can be seen and appreciated. With figure 8*B* in mind, the reader should visualize as a direct contrast a frontal sinus arising from the first frontal pit. In the latter case, the frontal sinus or its connection is in vertical alinement with its genetic point in the frontal recess. In some cases in which the frontal sinus arises from the third or fourth frontal pit or from the suprabullar region the nasofrontal connections are angulated and the ethmoidal bulla may project ventralward suffi-

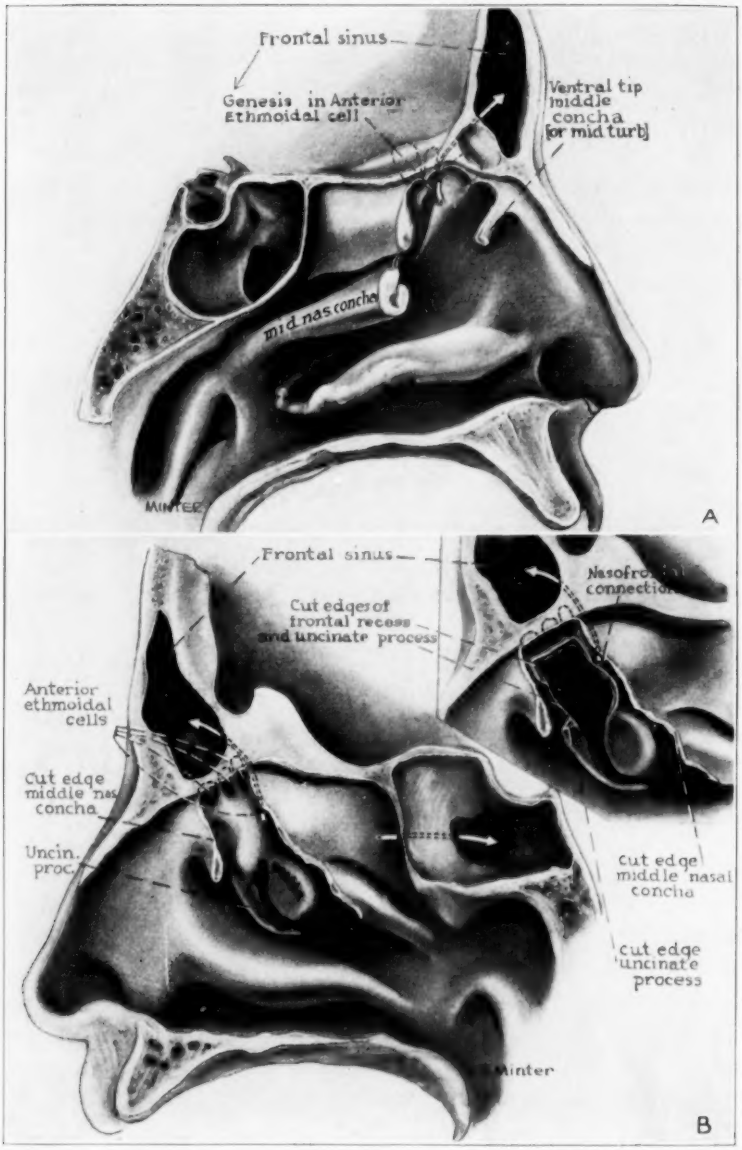

Fig. 8.—*A*, dissection from an adult. The nasofrontal connection arose from a frontal pit lying in the same axis as the ethmoidal infundibulum and simulates a direct anatomic continuity with the infundibulum. Observe the unusual distance between the ventral tip of the middle turbinal and the free border of the uncinate process. *B*, dissection from an adult. Note the tortuous nasofrontal connection which arose from a frontal pit in alinement with a suprabullar furrow. The ethmoidal bulla is prominent and projects far medialward. Note the blind ending of the ethmoidal infundibulum lateral to the frontal recess.

ciently far to make entrance to the frontal sinus impossible. Obviously, to effect entrance in such cases the bulla would have to be removed. As a general rule, the nasofrontal connection increases in obliquity and tortuosity as its genetic point moves from the ventral to the dorsal pits or furrows of the frontal recess.

6. REDUPLICATION OF THE FRONTAL SINUS AND THE NASOFRONTAL CONNECTIONS

Reduplication of the frontal sinus with accompanying variations in the nasofrontal connections is a common finding. After the fetal illustrations have been referred to and the fact that any or all of these frontal pits in the fetus are potential frontal sinuses has been called to mind, findings in adults should occasion no surprise. These are easily understood if one thinks of the frontal sinuses as ethmoidal cells growing beyond the confines of the ethmoidal mass into the various parts of the frontal bone.

In 8 per cent of the one hundred dissections, multiple frontal sinuses appear in the several portions of the frontal bone, which arrange themselves in a variety of ways. Some are tierlike in the vertical plane, some side by side, some in a row from before backward. Different combinations of these arrangements occur. One point of importance, however, is that each sinus has a separate nasofrontal connection with the middle nasal meatus, the location of each connection being determined by the early ethmoidal cell from which the particular sinus arose. It can be seen that in the presence of two or more frontal sinuses and nasofrontal connections the most important connection may be left unopened with resultant clinical failure (figs. 5 *B*, 6 and 12 *B*).

SUMMARY

Simultaneous study of dissections from adults and fetuses is necessary to interpret correctly the anatomy of the adult nasofrontal connections.

In this study of one hundred adult nasofrontal connections, the frontal sinus or sinuses are found to develop in the following ways: (1) in 57 per cent, by expansion of a frontal anterior ethmoidal cell or cells in the frontal recess; (2) in 34 per cent, by expansion of an infundibular anterior ethmoidal cell or cells in the ethmoidal infundibulum; (3) in 4 per cent, by direct expansion of the ethmoidal infundibulum; (4) in 3 per cent, by direct extension of the frontal recess, and (5) in 2 per cent, by expansion of a cell or furrow in the suprabullar region.

The foregoing figures show that in 62 per cent of cases the nasofrontal connection is not *directly* related anatomically to the ethmoidal infundibulum (groups 1, 4 and 5). In 57 per cent the connection has

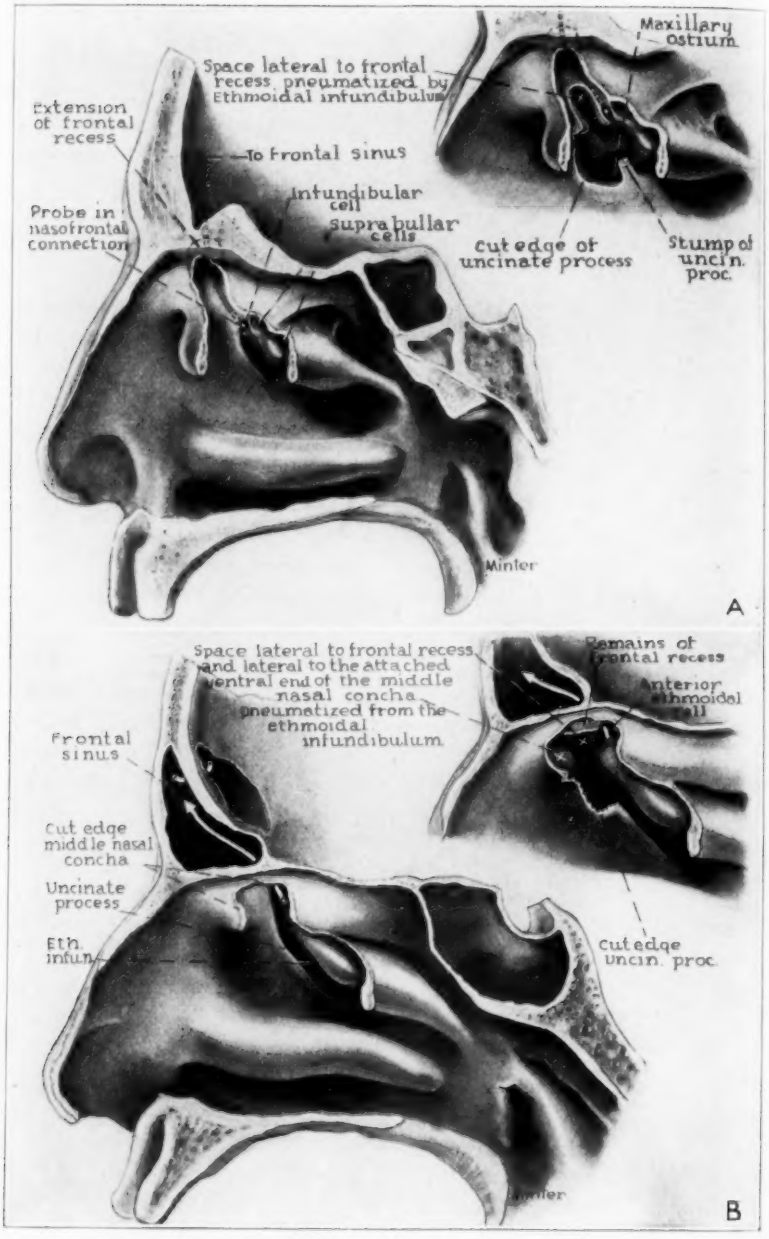
Maxillary ostium
Space lateral to frontal recess pneumatized by Ethmoidal infundibulum
Extension of frontal recess
To frontal sinus
Infundibular cell
Supra bullar cells
Probe in nasofrontal connection
Cut edge of uncinate process
Stump of uncin. proc.
Minter
A
Space lateral to frontal recess and lateral to the attached ventral end of the middle nasal concha pneumatized from the ethmoidal infundibulum
Remains of frontal recess
Anterior ethmoidal cell
Frontal sinus
Cut edge middle nasal concha
Uncinate process
Eth. infun.
Cut edge uncin. proc.
B

Fig. 9.—*A*, dissection from an adult. The frontal recess extends frontalward but not far enough to pneumatize the frontal bone. There is no evidence in the frontal recess that frontal pits or furrows were present. Note that the nasofrontal connection had its genesis in an infundibular cell. (Compare with figure 11.) *B*, dissection from an adult. Especially note the extensive pneumatization of the ethmoidal infundibulum lateral to the frontal recess and the attached ventral end of the middle concha. The nasofrontal connection most likely had its genesis in a frontal pit lying in the same axis as an infundibular cell. Note the tortuosity of the nasofrontal connection.

its genesis in a frontal pit or furrow; in 3 per cent it is a direct extension of the frontal recess, and in 2 per cent it grows from a suprabullar cell.

A fairly direct relationship exists between the nasofrontal connections and the ethmoidal infundibulum in 38 per cent of cases (groups 2 and 3). Indeed, in 4 per cent of cases the ethmoidal infundibulum and the frontal sinus are in direct anatomic continuity. In the remaining 34 per cent, an infundibular anterior ethmoidal cell, located in the ventral portion of the ethmoidal infundibulum, appears to be responsible for the origin of the frontal sinus.

In this series of one hundred dissections, there is a definite tendency for the ethmoidal infundibulum and infundibular cells to evaginate ventralward and cephalicward beneath the free border of the uncinate process. Indeed, it is very common to find the evagination extending sufficiently far to pneumatize the region lateral to the attached ventral end of the middle concha or turbinal. Occasionally, the extension of the ethmoidal infundibulum or infundibular cells leads to pneumatization of the agger nasi region. In the majority of cases the region lateral to the frontal recess is pneumatized by extension of the ethmoidal infundibulum and by infundibular cells. Indeed, it is a constant finding in groups 1, 4 and 5. Knowledge of this frequent blind ending of the ethmoidal infundibulum is of importance to the physician operating on the nose. It should also be mentioned that some of the specimens obtained near term show a marked early tendency toward infundibular evagination lateral to the frontal recess.

The factors which influence drainage of the frontal sinus are many and diverse. In the group of frontal sinuses which arise from pits in the frontal recess or from the frontal recess as a whole, roominess of the frontal recess varies in accord with these two types. The location of the genetic pit in the frontal recess, whether in a ventral or a dorsal position, is also important. Cases are encountered in which a rapidly growing early infundibular or frontal cell by vigorous and extensive evagination distorts the normal growth of an early frontal cell destined to form the frontal sinus, and as a consequence there is formed a nasofrontal connection which is tortuous, narrow, and poorly equipped for frontal drainage. It should be remembered that in a few cases the frontal recess assumes a shelflike formation projecting far medialward into the nasal cavity. In the last named type, if drainage is to be effected, the ventral end of the middle turbinal will have to be resected very high, otherwise blockage will continue. In some instances in which the operator is desirous of enlarging the nasofrontal connection, knowledge of the type at hand will be of value. For instance, a nasofrontal connection originating from pit 1 in the frontal recess has but a short distance to travel ventralward before the frontal plate of bone is reached,

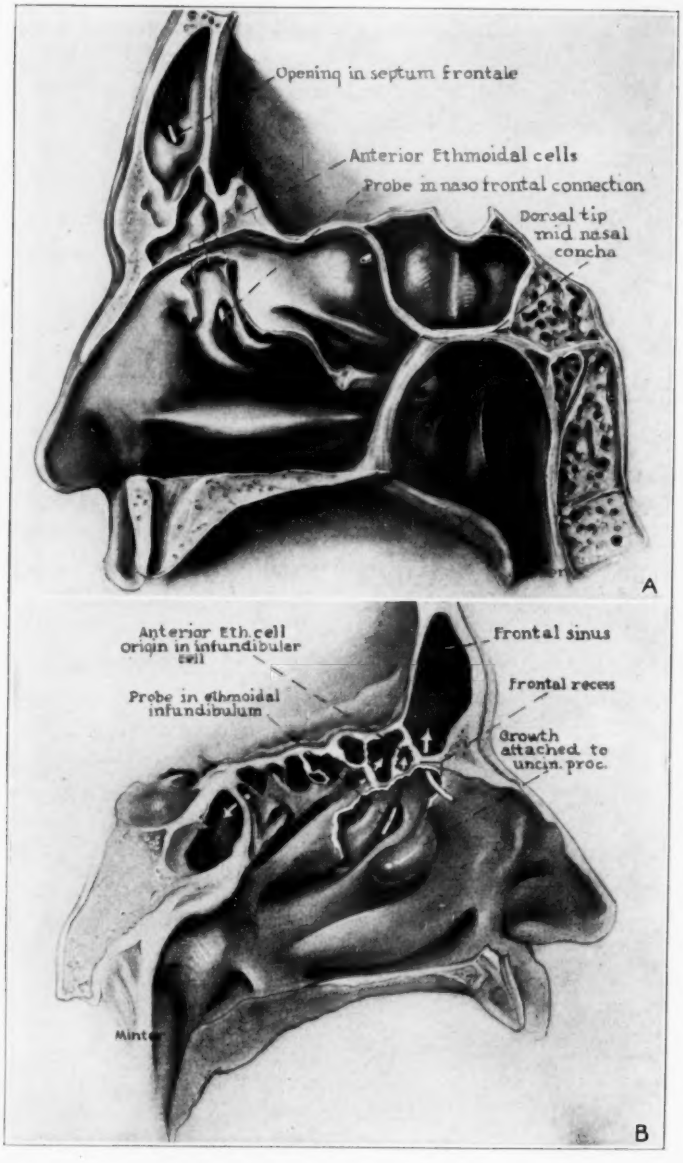

Fig. 10.—*A*, dissection from an adult. Note the nasofrontal connection in direct anatomic continuity with the ethmoidal infundibulum. The early frontal pits have remained quiescent. The septum frontale is extremely thin and presents a large natural opening between the right and the left frontal sinus. *B*, dissection of an adult lateral nasal wall. Note that the frontal sinus is formed by a direct extension of the entire frontal recess. The distortion of the frontal recess is due to an expansion of an infundibular anterior ethmoidal cell.

but one originating from pit 4 has a greater distance to travel ventralward before it reaches the frontal plate. Consequently more tissue can be removed and the resultant opening for drainage will be larger.

Reference to the entire group of illustrations in this series brings out the great diversity in the marginal attachments of the middle turbinals, and this diversity should be borne in mind for its possible influence on the nasofrontal field. It is obvious that these variations in the degree of fusion of the middle turbinal with the ethmoidal bulla and the uncinate process in the region of the frontal recess affect the

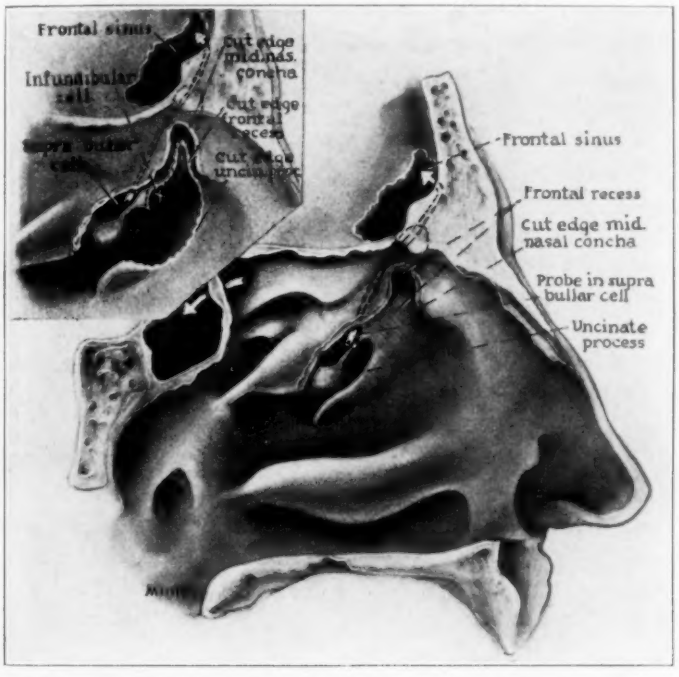

Fig. 11.—Dissection from an adult. Note that the tortuous nasofrontal connection had its origin in a suprabullar furrow. (Compare with figure 9*A*, a dissection of the opposite lateral nasal wall.) Note the similarity in location of infundibular cells and compare the origins of the frontal sinuses.

size and roominess of the frontal recess. Indeed, in some cases the frontal recess is largely wanting. When this occurs, one expects a distinctive type of nasofrontal connection to be present, and when known beforehand the information is of distinct value. One should bear in mind, in examining certain of the types shown, that drainage from the frontal field may be retarded or actually blocked by imperfect removal of an operculating middle concha or turbinal. In other types,

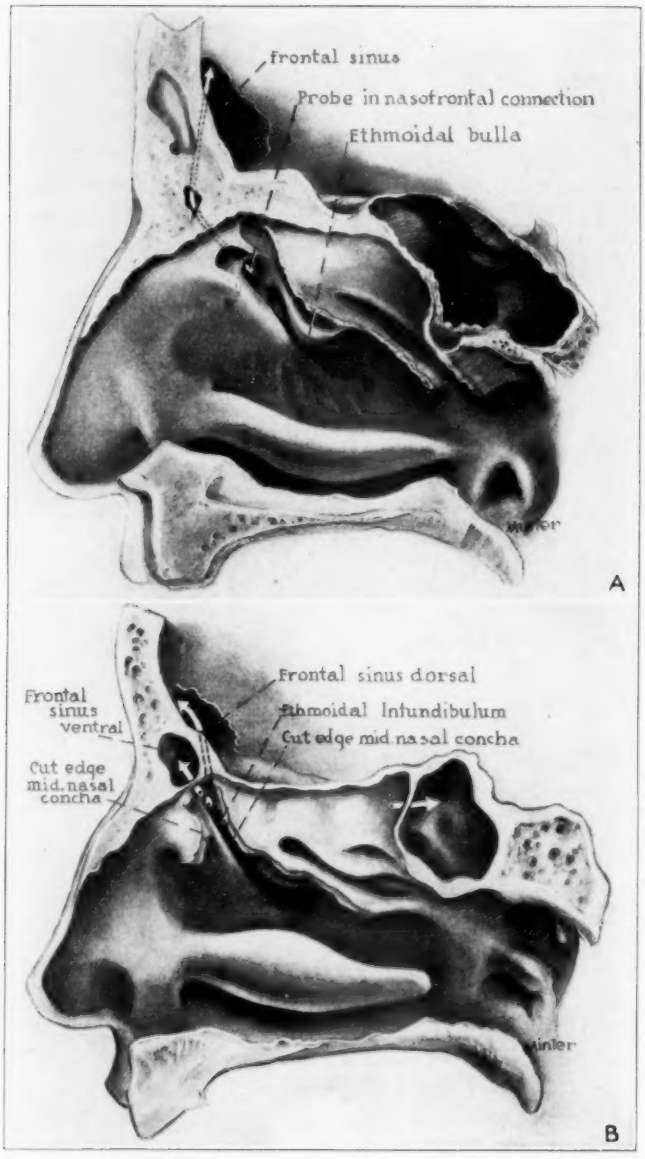

Fig. 12.—*A*, dissection from an adult. Note the nasofrontal connection in direct alinement with the ethmoidal infundibulum. A cell located in the ventral extremity of the ethmoidal infundibulum extends to form the frontal sinus. *B*, dissection from an adult. Note the multiple frontal sinuses and the nasofrontal connections. The ventral sinus drains into the frontal recess while the dorsal sinus empties into the ethmoidal infundibulum.

a middle turbinectomy would have no influence on drainage from the frontal field.

Of course, the ethmoidal infundibulum is less likely to receive secretion from the frontal sinus in that large group in which the latter sinus arises from a frontal pit in the frontal recess. The presence or absence of an intimate relationship between the frontal sinus and the ethmoidal infundibulum only partly determines whether or not secretion from the frontal sinus will involve the maxillary sinus secondarily. Other factors contributing their influence are variations in the size of the maxillary ostia and variations in the size and arrangement of the ethmoidal infundibulum, and under the latter are those specimens which show a dorsal blind ending of the ethmoidal infundibulum.

In view of the importance in which the ethmoidal infundibulum is held as an intranasal landmark, it is well to remember, in passing a sound through the nasofrontal connection, that in 62 per cent of cases the ethmoidal infundibulum and the nasofrontal connections are discontinuous channels anatomically, while in 34 per cent of cases a state of anatomic contiguity exists, and in 4 per cent a state of direct anatomic continuity is present. It is important also to bear in mind, when passing a sound through the nasofrontal connection, the prevalence of small ostia, impossible angles and obstructing ethmoidal bullae.

The group of dissections demonstrating the suprabullar genesis of the frontal sinus brings forcibly to one's attention the difficulty arising in attempting to pass a sound into the frontal sinus. The same difficulty arises when a frontal pit lying far dorsalward on the frontal recess gives origin to the frontal sinus. Apparently a preliminary exenteration of tissue would be necessary before the frontal sinus could be entered. These cases which present difficulty in locating the ostia owing to tortuosity and angulation should not be confused with cases showing an absence of pneumatization in the squama frontalis. A persistent effort to find a nasofrontal connection where none exists has been known to end disastrously.

In the presence of a reduplicated frontal sinus a very confusing picture often presents itself. If the ostium to the larger sinus lies extremely high and happens to be extremely small, while the second frontal sinus opens through a relatively large ostium at a much lower level, the chances for errors are obvious. In general, it may be said that in all cases of reduplicated frontal sinus there is a stronger likelihood of failure to effect proper drainage. In the presence of multiple frontal sinuses communicating independently with the frontal recess, the intranasal approach would more readily effect drainage for all of them than the exterior operation, which might open and drain only one of them. In saying this I am referring to an anatomic fact only.

Clinical Notes

EPHEDRINE IN PHYSIOLOGIC SOLUTION OF SODIUM CHLORIDE AND LATERAL HEAD-LOW POSTURE IN TREATMENT OF THE NOSE AND SINUSES

SIDNEY M. PARKINSON, M.D., OAKLAND, CALIF.

During the past decade or so a great and varied assortment of drugs and mixtures has come to be used in the nose for local treatment of colds and sinusitis. The very diversity clearly indicates confusion in the purposes and anticipated effects of such treatment, for by no interpretation of physiologic facts can one correlate such different substances as oils, colloids, antiseptics, bacterial lysates, electrolytes, epinephrine, cocaine, ephedrine and the innumerable combinations that can be made from these.

One would do well, therefore, to pause and ask what one hopes to accomplish by local treatment. There are three possibilities: (1) shrinkage of mucosa to improve drainage of the sinuses; (2) destruction of pathogenic bacteria, and (3) stimulation or restoration of physiologic response of the tissue. In each instance one would wish to avoid any subsequent depression of, or harmful effect on, normal function or tissue.

What one may in fact accomplish by local treatment is another question. Investigation of the actual effects of various drugs and fluids on the ciliated nasal and sinus mucosa has long been needed. Such work has been done during the past year or two by competent workers in widely separated medical centers. Their findings furnish the first scientific evidence available.

One needs first to consider the physiology of ciliated mucosa, the local response to infection and the tissue's own methods of overcoming infection and returning to normal. While much has yet to be learned on these subjects, sufficient information is available to give one a fairly clear pattern.

The functioning structure of the entire nasal and sinus tract consists of thin columnar, ciliated epithelium. Normal physiologic activity, to the extent with which one is concerned with it here, consists of constant ciliary sweeping plus the steady outpouring of sufficient serous and mucoid fluid to keep the surface moist in which the cilia beat and to humidify the inspired air.

All ciliary sweeping within a sinus is toward the ostium. All nasal sweeping is toward the pharynx. The final destination of all ciliary drainage is the mouth of the esophagus, where it is swallowed.[1]

Ciliary flow is at the rate of 0.5 cm. per minute, requiring about five minutes to pass from anterior to posterior parts of the nasal chambers. This constitutes the chief cleansing and defense mechanism of the upper respiratory tract. Proetz[2]

1. Hilding, Anderson: The Physiology of Drainage of Nasal Mucus: I. The Flow of the Mucus Currents through the Drainage System of the Nasal Mucosa and Its Relation to Ciliary Activity, Arch. Otolaryng. **15**:92 (Jan.) 1932.

2. Proetz, Arthur W.: Effects of Drugs on Living Nasal Cilia, Ann. Otol., Rhin. & Laryng. **43**:50 (June) 1934.

has said: "To my mind the cilia are by far the most potent factor in maintaining and restoring nasal health."

Other defense factors are present, such as phagocytic cells in small number which wander throughout the mucosa and antibodies in varying strength. The secretions are slightly antiseptic owing to the presence of lysozyme.[3]

At the onset of infection defense is concerned with keeping up the ciliary cleansing, pouring out additional mucus and mobilizing phagocytes and antibodies. These processes are more or less disturbed and impeded by the bacterial toxins, and there is an initial sharp decrease in the effectiveness of lysozyme.

The earliest sweepings of toxins and bacteria down the pharynx and toward the esophagus are of course the most toxic, owing to the temporary lack of immunity of the tissues. Hence the early sore throat, laryngitis, malaise and other symptoms.

When early resolution fails to take place the infection progresses with more local discomfort and more disturbance of function. Nasal congestion occurs, and there is an outpouring of mucopus in reaction to bacterial invasion of the mucosa. Congestion, overload of secretions and prolonged contact with toxins impair ciliary activity. Further interference comes from drying of purulent film. Large areas of cilia may become paralyzed, allowing accumulation of mucopus. Drainage of the sinuses is further impaired because blockage of the meatuses shuts off the essential stimulation to ciliary activity that comes from the plus and minus alternation of air pressure during respiration.[4] Perhaps the worst interference is from the drying, which paralyzes all affected cilia.[5]

Local treatment during a nasal infection can be of direct aid to some functions of the mucosa and of indirect aid to others. On the other hand, it may be distinctly harmful, or it may so combine harmful with useful effects as to nullify the latter. To be logical and useful it must tend toward removal of factors interrupting ciliary and other mucosal defense activities.

Shrinkage of the mucosa relieves congestion and restores the action from alternating air pressure. This alone goes far toward restoration of function. Emptying the nasal chambers and sinuses of retained secretions and moistening the epithelium give further aid, as does any actual stimulation of ciliary activity.

How to accomplish these things with the least trauma, physical or chemical, is the essential problem, for it is obvious that to whatever extent a drug or method is harmful it counteracts whatever good it does.

Concerning the various drugs commonly used for treatment of the nose, recent experimental work, particularly by Lierle and Moore[6] and Proetz,[2] is of prime interest. With fresh ciliated epithelium from the human nose the effect of drugs was studied at close range. Whenever compatible the drugs were used in physiologic solution of sodium chloride. Notable investigation of tissue response has been

3. Hilding, Anderson: Changes in the Lysozyme Content of the Nasal Mucus During Colds, Arch. Otolaryng. **20**:38 (July) 1934.

4. McMurray, John: Intra-Antral Air Pressure Incident to the Respiratory Excursion, and Its Effects on Antral Drainage, Arch. Otolaryng. **14**:581 (Nov.) 1931.

5. Proetz, Arthur W.: Studies of Nasal Cilia in the Living Mammal, Ann. Otol., Rhin. & Laryng. **42**:78 (Sept.) 1933.

6. Lierle, D. M., and Moore, P. M.: Effects of Drugs on Ciliary Activity of Mucosa of Upper Respiratory Tract, Arch. Otolaryng. **19**:55 (Jan.) 1934.

reported by Fenton and Larsell[7] and McMahon.[8] A brief résumé of the work of these investigators is as follows:

Physiologic solution of sodium chloride appears to have no effect on ciliated membrane. Tissue immersed in it for several hours shows normal ciliary function. This is explained by its similarity to the normal fluids in the nose. The solution therefore appears to be an ideal vehicle.

On the other hand, tap and distilled water promptly stop all ciliary activity. Yet almost without exception drugs used in the nose are put up either in plain water or in oil. On the basis of his work with ciliated mucosa that had been immersed in salt solution of 0.9 per cent concentration, Proetz wrote:[2] "If the concentration of the solution is reduced, the sharp outlines of the cilia are gradually lost and the surface becomes cloudy. Even groups of cilia can no longer be distinguished, and all motion ceases at 0.2 to 0.3 per cent salt concentration. Addition of sodium chloride now fails to restore motion. The cilia have been permanently disabled." Further, ". . . the cleansing mechanism, in the plan of treatment, deserves every consideration and assistance. If one paralyzes the overlying cilia he has disabled his best ally."

Liquid petrolatum causes marked slowing of the ciliary stream by the simple mechanism of lying as a heavy inert blanket on the surface. Yet this is the same oil that one has so often heard described as "soothing" and "harmless."

From 0.5 to 3 per cent solution of ephedrine in physiologic solution of sodium chloride is harmless to ciliary activity and may even cause sustained acceleration. There is no evidence of a subsequent period of fatigue. In view of the effectiveness of ephedrine on shrinking engorged mucosa, this seems to be a truly useful drug in a harmless vehicle. Obviously it is illogical to use ephedrine in oil or in plain water, nor can its true virtues be estimated in such vehicles.

Argyrol and neosilvol are colloids incompatible with salt solution, and they cause definite slowing of ciliary activity. This slowing is explained as due to the plain water solvent, to precipitation or clumping of the drug over the surface as it comes in contact with the saline mucus and to electrolysis which takes place spontaneously between such colloids and living tissue. McMahon[8] found that each of these drugs in a 10 per cent concentration in contact for twenty minutes with the mucosa of the frontal sinuses of the dog caused edema and intense cellular concentration throughout the mucosa and actual fragmentation of the columnar epithelium. If such a cellular reaction can be interpreted as useful, then edema and epithelial fragmentation seem an enormous price to pay for it. Fenton and Larsell[7] unhesitatingly concluded that "colloid substances are destructive to epithelium, and favor infection by impairing ciliary action," a significant commentary on the long established and widespread empirical use of these drugs in the nose.

Cocaine in more than 2.5 per cent strength causes slowing or paralysis of the ciliary activity.

Epinephrine in a 1:1,000 dilution causes immediate paralysis of the cilia, while a dilution of 1:5,000 causes slowing of the activity.

Eucalyptol, menthol, thymol, zinc sulphate and mercurochrome all definitely slow or paralyze ciliary activity. Merthiolate even in a dilution of 1:10,000

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7. Fenton, R. A., and Larsell, O.: Experimental and Clinical Study of Histiocytes in Acute and Chronic Inflammation of the Nasal Accessory Sinuses, Laryngoscope **43**:33 (April) 1933.

8. McMahon, Bernard J.: Effects of Ionization on the Mucosa of Frontal Sinuses of Dogs, Ann. Otol., Rhin. & Laryng. **43**:44 (Sept.) 1934.

causes slowing of ciliary activity. In greater concentration this effect is proportionately more prompt and more paralyzing.

Ionization as a method of treatment has been found to be definitely destructive to epithelium.[8]

Proetz[2] found that even the small amount of merthiolate (1:5,000) required to keep the preparation of streptolysate sterile was sufficient to paralyze the cilia.

It appears, therefore, that of the drugs and fluids mentioned only ephedrine in physiologic solution of sodium chloride produces effects useful in treatment and at the same time avoids harmful effects such as slowing or paralysis of ciliary activity and disabling or destruction of epithelium. Its action tends directly toward maintenance of physiologic function, and it is on such function that one depends for recovery.

It is my desire to recommend an effective means of administering ephedrine. For more than three years I among others have used a posture, the lateral head-low position, wherein the head is dependent and to the side. In this posture a 1 per cent solution of ephedrine in physiologic solution of sodium chloride is instilled into the nasal chambers. This procedure has been fully described with illustrations elsewhere,[9] but a brief discussion of it here seems worth while.

There is no doubt that head-low posture is the best means of reaching the irregular and intricate spaces and structures of the upper nasal areas. There is a prevalent misconception, however, that adequate posture is obtained with the patient lying supine with the head bent backward, a posture described by Proetz[10] some years ago. In this position only the sphenoid and posterior ethmoid sinuses are adequately dependent. It must be borne in mind that the ostia of the antrums and the anterior ethmoid and frontal sinuses are considerably in front of and below the level of the sphenoid group. When the head is bent backward these ostia lie above, and in front of, any fluid instilled into the nose. Yet in the average case of acute infection it is these sinuses of the anterior group that are chiefly involved.

If the patient is placed exactly sidewise, with the lower shoulder supported by a few pillows, the head can be comfortably bent downward laterally to a dependent position wherein all the ostia of both groups of sinuses and of both sides are available to fluid instilled into the nose. The correctness of this can be verified by consulting a skull or even a drawing of the anatomy of this area. It is not necessary to have the head completely upside down. Inversion in the neighborhood of 45 degrees has been satisfactory. This has been repeatedly demonstrated with iodized poppy-seed oil 40 per cent. All the sinuses of one or both sides can be partially filled with this radiopaque fluid by the use of suction displacement as described by Proetz.[10]

The technic of treatment consists of first getting as thorough ventilation as possible by spraying the nose at intervals of several minutes with from 1 to 3 per cent solution of ephedrine in physiologic solution of sodium chloride. The patient is then placed in the lateral posture, a 1 per cent solution of ephedrine is instilled into both nostrils (at least one dropperful in each side), and the position is held for from three to five minutes. The ephedrine is thus enabled to exert its shrinkage effect in the upper meatuses and about all the ostia. During this time oral breathing will prevent the fluid from being drawn into the pharynx. Finally,

9. Parkinson, Sidney N.: A Lateral Head-Low Position for Nasal and Sinus Treatment, Arch. Otolaryng. **17**:87 (June) 1933; Observations on Postural Treatment of Upper Respiratory Infection, J. Pediat. **6**:809 (June) 1935.

10. Proetz, Arthur W.: Displacement Irrigation of Nasal Sinuses, Arch. Otolaryng. **4**:1 (July) 1926.

the patient's head is rotated to face downward to allow the fluid nasal contents to be expelled from the nose. The patient should remain face downward for several minutes.

One of the distinct advantages of this posture is that it is unnecessary that any of the fluid nasal contents at any time enter the pharynx. This is important because of the distastefulness of the drug and because it minimizes the amount of absorption. To swallow much ephedrine causes transient palpitation in some adults. This is usually avoidable by care in giving the treatment; otherwise by giving by mouth 1½ grains (0.102 Gm.) of amytal or some other sedative. However, in my experience this factor has been of almost negligible importance.

If one wishes as part of the treatment to have some of the solution actually enter the sinuses, this is easily accomplished by gentle suction on the nostrils with the pharynx closed. For patients with a subacute infection, whether children or adults, this has been found of great value in hastening emptying from the sinuses of mucopurulent accumulations. From its known action on ciliated mucosa ephedrine actually within a sinus would be a physiologic aid by reducing congestion. This would permit more effective ciliary sweeping and would keep the ostium open.

The lateral head-low position for postural treatment. Note that the roof of the nasal fossae is approximately level in the anteroposterior plane. This insures the fluid reaching all the upper meatuses and ostia of all the sinuses. The position is comfortable, and there is little or no sensation from the instillation of 1 per cent ephedrine in physiologic solution of sodium chloride.

It is believed that by this procedure ephedrine in physiologic solution of sodium chloride can be most advantageously brought in contact with the meatal mucosa and the ostia of the sinuses and even with the mucosa of the sinuses if so desired. It has served well as a routine method in the treatment of sinusitis and so-called bad colds, whether in children or in adults. It entails almost no discomfort. It does not traumatize the mucosa either physically or chemically, so there is no local reaction. The method is easily carried out and requires no special equipment. It can be applied in any office or in any home and may be repeated as often as appears necessary, especially in children. It requires a little more time and attention than is usually given these patients, but the results fully justify this. Between treatments patients can assist by keeping the nasal passages open with a spray of from 1 to 3 per cent solution of ephedrine in physiologic solution of sodium chloride.

In cases in which checking a cold at the onset is considered most important, I start local treatment as early as a cold is recognizable with a view to main-

taining the defense mechanism by maintaining mucosal and ciliary function. With ephedrine in physiologic solution of sodium chloride this may be done without fear of harmful local effects.

The preparation of ephedrine found most satisfactory for postural treatment is as follows:

Sterilized Berkefeld filtered tap water rather than distilled water is used. To this is added sodium chloride to 0.9 per cent and ephedrine sulphate to 1 per cent. The reaction of this solution is found to be in the neighborhood of p_H 7.4, but if not it is usually on the acid side and requires the addition of a small amount of base. A useful indicator is bromthymol blue. No preservative or antiseptic has been found necessary. The solution is odorless, colorless and clear and appears to be relatively stable.

Not only have results been good with this method of treatment, but certain desirable changes in the routine care of patients have been made possible:

1. The use of tampons and other intranasal procedures requiring instrumentation can be discarded. Postural treatment has been found more effective and avoids all trauma to the ciliated mucosa.

2. There is no anatomic or other justification for the use of so-called nose drops with the instructions to instill with the head tilted back. Such treatment has nothing to recommend it, and nothing could be more futile. Fluid thus used can do no more than run directly backward into the throat and can reach no higher than the dependent border of the lower turbinate. Ephedrine used in this way will produce only general symptoms from being swallowed, with no local benefit.

3. Therapeutic lavage of the antrums, long overused, seldom becomes necessary. Postural treatment gives adequate drainage; it reaches both antrums at once, and it has the added advantage of reaching the associated ethmoid cells so commonly involved with the antrums. It makes it possible for the cells to empty themselves by their own undamaged ciliary mechanism.

4. The operation of making intranasal antrum windows is rarely indicated. One has means of greater control over the condition and hence can often avoid surgical intervention that would otherwise seem indicated in cases of acute and subacute disease. Surgical intervention is thus reserved to a greater extent for cases of chronic pathologic processes, to which it properly belongs and in which it finds a legitimate field of usefulness.

The method of local treatment described rests on sound anatomic, physiologic and pharmacologic principles. Also, it fulfils to a greater degree than has heretofore been possible all the purposes desired in the control of acute and subacute infection of the upper respiratory tract: (1) earlier termination of infection, (2) prevention of complications and (3) prevention of chronicity.

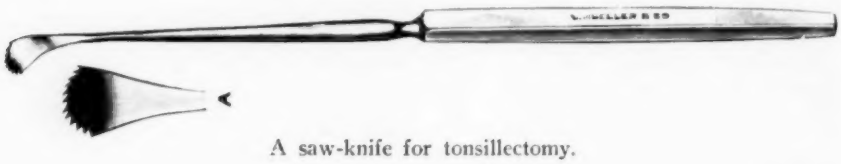
A SAW-KNIFE FOR TONSILLECTOMY

M. P. Palmer, M.D., Oak Park, Ill.

Being dissatisfied with the available instruments for removing fibrosed tonsils, I designed the instrument shown in the figure.

The design of the saw-knife is based on that of the Pierce tonsil knife. The lateral edges are flattened and blunted, and numerous fine serrations are made in the cutting blade, which is then honed to as sharp an edge as the thickness of the blade permits.

The tonsil is grasped with a tenaculum at the midportion and is pulled medially. With a sharp instrument an incision is made into the reflection of mucous membrane behind the anterior pillar. The reflections over both pillars are split with a Tyding knife, and the superior pole is freed with the same instrument. The tenaculum is reapplied to the superior pole, and the tonsil is rotated medially and downward to expose the tonsillar bed. The saw-knife is slipped down over the superior pole of the tonsil, and the organ is stripped free by a downward and medial gentle pull. When firm adhesions are encountered the saw-knife is rocked laterally which action easily cuts the fibrous bands without placing undue tension on the throat. This maneuver is continued as far down into the pharyngeal apron of lymphatic tissue as possible. The freed tonsil is finally removed with a Tyding snare.



A saw-knife for tonsillectomy.

The instrument is especially valuable for the removal of tonsils of elderly persons and of tonsils which have become fibrosed from repeated infection and peritonsillar abscesses and for the removal of fibrosed tags. Its use greatly reduces the pain from tension during tonsillectomy with local anesthesia, because the instrument cuts clean rather than forcibly pulling the tonsil free from its attachments. The danger of cutting into the pharyngeal musculature is minimized, as the main line of force is downward and medially, away from those muscles. By carrying the sharp dissection far down, a clean wound results, and the percentage of regrowth of tags from the base is materially lessened.

The instrument is made by V. M. Mueller & Company, Chicago.

732 North Austin Boulevard.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

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PERORAL ENDOSCOPY

LOUIS H. CLERF, M.D.
ASSISTED BY DANIEL C. BAKER JR., M.D.
PHILADELPHIA

GASTROSCOPY

New diagnostic aids or procedures become valuable and attain popularity only when they can be employed with safety by those skilled in their use and when they either supplement or supplant methods previously employed. Gastroscopy, practiced with the open tube, has been accepted for a long time as a valuable aid in the removal of a foreign body from the stomach. However, visualization of the interior of the stomach by this means has not met with general favor for several reasons, chief among these being the necessity for expert training in the passing of the tube safely and the impossibility of visualizing a great part of the interior of the stomach.

Peroral Gastroscope.—The recent development by Wolf and Schindler of a flexible gastroscope with a lens system has contributed greatly to the diagnostic possibilities in cases of gastric disease. In discussing the advantages of the flexible gastroscope Schindler [1] described the contraindications and indications for its use and the technic of introduction. The contraindications are practically the same as those for the passage of a stomach tube, such as the presence of an aneurysm of the aorta, angina pectoris or an esophageal varix. Obstruction of the esophagus is an absolute contraindication. If there is a question concerning the presence of disease of the esophagus, a fluoroscopic study should be made. A remarkably sharp and clear view of the gastric mucosa can be secured; in fact, small hemorrhagic or pigment spots can be seen distinctly. The pylorus can be visualized in at least 80 per cent of cases. The question regarding the existence of chronic gastritis has been settled decisively by gastroscopy; in fact, Schindler has found gastritis to be of frequent occurrence. He has distinguished three forms, namely, superficial gastritis, atrophic gastritis and hypertrophic gastritis.

1. Schindler, R.: Diagnostic Gastroscopy with Special Reference to the Flexible Gastroscope, J. A. M. A. **105**:352 (Aug. 3) 1935.

Schindler expressed the opinion that the flexible gastroscope has made it possible to visualize the interior of the stomach with safety and with relatively little discomfort to the patient. The flexible gastroscope affords an additional method for the direct morphologic diagnosis of gastric disease. Gastroscopy not only supplements the roentgen examination in the direct diagnosis of gastric ulcer and gastric neoplasm but aids greatly in their differential diagnosis. It also furnishes direct evidence of the progress of a benign lesion and of the degree of involvement in a case of neoplasm. Gastroscopy reveals gastritis and other changes in the gastric mucous membrane not discernible by other procedures.

In a consideration of peroral gastroscopy the Jacksons [2] discussed the methods of gastroscopy with an open tube and with a lens system. The danger in gastroscopy is associated with the introduction of the tube through the esophagus, particularly at the cricopharyngeal and hiatal constrictions. The open tube method, if employed by a trained operator, should be free from danger, since the esophageal lumen can always be seen ahead. The tube should never be advanced unless the lumen is visible. The gastroscope with a lens system does not give a view of the lumen ahead; therefore, any disease of the esophagus constitutes a contraindication to the use of this instrument. The dangers incident to its use can be eliminated, however, by preliminary exclusion of esophageal disease through roentgen examination and esophagoscopy and by careful introduction of the instrument. Flexible tube gastroscopy in diagnosis is desirable since a great part of the stomach can be inspected. It does not permit of biopsy, however, and for this the open tube is necessary. Also for the removal of a foreign body the open gastroscope is required. The Jacksons expressed the opinion that every patient with gastric symptoms should have a gastroscopic examination for diagnosis unless there are overbalancing contraindications. Hematemesis also is a strong indication for direct examination, whether the blood is red or brownish. In all such cases examination with the open tube should be performed first to exclude esophageal disease. A diagnosis of gastric neurosis or of hysteria with gastric manifestations should not be made until both esophagoscopy and gastroscopy have excluded organic disease of the esophagus and stomach.

Until recently the term chronic gastritis has been employed vaguely to designate a variety of disorders. According to Benedict,[3] the diagnosis of chronic gastritis has rested on insecure foundations, based largely on indefinite symptomatology and the exclusion of other organic disease

2. Jackson, C., and Jackson, C. L.: Peroral Gastroscopy Including Examination of the Supradiaphragmatic Stomach, J. A. M. A. **104**:269 (Jan. 26) 1935.

3. Benedict, E. B.: Chronic Gastritis: A Clinical Discussion Based on Gastroscopic Examination, New England J. Med. **212**:468 (March 14) 1935.

by roentgen study. With the introduction of the flexible gastroscope an easy and accurate diagnostic method is available for the careful inspection of the gastric mucosa. Benedict emphasized the fact that chronic gastritis is a definite disease and that in its accurate diagnosis gastroscopy is the most valuable method of examination. The importance of chronic gastritis lies not only in its existence as an independent disease but in its possible relationship to gastric ulcer and carcinoma. Hemorrhage is a more common complication of gastritis than is generally supposed. The author stated that in his opinion the flexible gastroscope provides a safe and practical method for clinical and research studies in this field.

In emphasizing the contraindications to the employment of the flexible gastroscope, Jackson [4] stated that he has been impressed with the importance of a careful fluroscopic examination of the lower end of the esophagus, as he has observed many patients with disease of this structure which simulated disease of the stomach. Although there are contraindications to the use of the Schindler gastroscope and although the open tube is better for certain purposes, there is no question that the flexible gastroscope marks a new era in the endoscopic study of the stomach. Jackson expressed the opinion that the day is not far distant when every gastro-enterologist will consider gastroscopy as a part of the routine study of patients with gastric symptoms.

In the opinion of Edwards,[5] the flexible gastroscope devised by Wolf and Schindler possesses advantages over all the other types of tube in that it is employed entirely without risk, it can be used without much discomfort to the patient and it permits of direct inspection of a greater portion of the interior of the stomach. One of the greatest difficulties lies in the interpretation of the findings and the orientation of the area inspected. This can be accomplished only after considerable experience. Gastroscopy is useful as a supplemental aid but does not supplant roentgen examination; in fact, a roentgenogram should always be made before gastroscopy is contemplated. Gastroscopy not only is a useful aid in corroborating a diagnosis but may be of value in checking the results of medical treatment. It is the best means at one's disposal in making a diagnosis of chronic gastritis. Edwards expressed the belief that the gastroscope has a definite field of usefulness in the care of patients with gastric disorders.

Although it has been commonly held that atrophy of the gastric mucosa is invariably present in cases of pernicious anemia, this was not corroborated by the observations made by Jones, Benedict and

4. Jackson, C. L.: Gastroscopy with the Flexible Gastroscope, Ann. Otol., Rhin. & Laryng. **44**:1150 (Dec.) 1935.

5. Edwards, H. C.: Value of Gastroscopy, Lancet **2**:1161 (Nov. 23) 1935.

Hampton.[6] These authors studied 5 cases of pernicious anemia. Observations of the stomach were made by gastroscopic and roentgenologic examinations, by direct examination at laparotomy and by histologic study of biopsy material. They observed that atrophy of the stomach occurred particularly during a relapse and was not a constant finding in the disease. After the employment of specific therapy for pernicious anemia, the atrophy tended to disappear. The authors stated that in their opinion the change from the appearance of atrophied to that of normal gastric mucosa frequently represented an epithelial change associated with the successful treatment of the specific deficiency state, rather than the healing of the chronic inflammatory process. Evidences of hypertrophic gastritis were observed by roentgen study during relapses and also during the early stages of the disease. The authors stated that they considered the apparent return of the gastric mucosa to normal from a grossly hypertrophic condition as representing a subsidence of the chronic gastritis. The observations made in their 5 cases have been recorded in detail.

In gastroscopic examinations performed on patients with manifestations of hypersensitivity Chevallier[7] observed a noninflammatory form of edema in the region of the pyloric antrum, which he said he believed to be of purely allergic origin. It appeared as a localized swelling which varied from a light rose to a rose-geranium color. It was essentially transitory, appearing and disappearing rapidly; at times it masked the pyloric orifice completely. It was often associated with migraine, a hepatic disorder, urticaria, asthma or some other condition suggesting vagosympathetic instability. The condition was favorably influenced by desensitization.

ESOPHAGOSCOPY

Esophagoscopy in Diagnosis.—In reviewing the literature on dysphagia associated with anemia known as the Plummer-Vinson syndrome, McGibbon[8] recorded the symptoms and clinical findings in a group of 7 cases. In 6 of these cases esophagoscopy revealed definite organic lesions of the esophagus. These consisted of muscular spasm at the upper entrance of the esophagus, occlusion of the upper aperture by a membranous diaphragm, organic stricture in the region of the cricoid cartilage or the postcricoid web and chronic esophagitis. The seventh

6. Jones, C. M.; Benedict, E. B., and Hampton, A. O.: Variations in the Gastric Mucosa in Pernicious Anemia: Gastroscopic, Surgical and Roentgenologic Observations, Am. J. M. Sc. **190**:596 (Nov.) 1935.

7. Chevallier, R.: L'oedème fugace de la région anthropylorique au cours des gastropathies allergiques: Etude gastroscopique, Bronchoscop., œsophagoscop. et gastroscop., April 1935, p. 129.

8. McGibbon, J.: Oesophageal Lesions Encountered in Cases of Dysphagia with Anaemia, J. Laryng. & Otol. **50**:329 (May) 1935.

patient was not examined esophagoscopically but presented a transition of a simple stomatitis to multiple malignant new growths of the buccal mucosa together with leukoplakia. The pathologic nature of the condition is unknown. There is considerable question whether the dysphagia precedes or follows the anemia. Many believe that the anemia is secondary to dietary restrictions consequent on dysphagia. It would seem that the esophageal lesions may be regarded as manifestations of a disease the underlying cause of which is a nutritional defect and that its frequent occurrence in women is probably due to the demands made by pregnancy and menstruation.

A group of patients observed by Winkelstein [9] presented a type of esophagitis that did not conform to the common classifications. The patients, all elderly men, complained of symptoms resembling those of peptic ulcer. These were of long standing and were characterized by exacerbations and remissions. There was an associated history of gastric or duodenal ulcer with hyperchlorhydria. Esophagoscopy in the cases reported revealed a diffuse inflammatory process, but no definite ulcer. Histologic study of tissue removed exhibited signs of inflammatory changes.

The presence of a diaphragmatic hernia can usually be demonstrated by roentgen study. The presence of intermittent dysphagia associated with pain and a sense of fulness in the epigastrium should suggest paraesophageal diaphragmatic hernia. However, one should not be entirely satisfied with the roentgen demonstration of a single lesion, as multiple lesions may occur in the esophagus. In 1 case reported by Vinson and Moersch [10] roentgen examination revealed herniation of about one third of the cardiac portion of the stomach through the esophageal hiatus. The authors stated that they considered that the hernia was responsible for all the symptoms, namely, dysphagia and epigastric pain. After the operation it was found that a stomach tube could not be introduced, and esophagoscopy revealed a stricture in the esophagus just above the cardia. In a second case the symptoms of herniation of a portion of the stomach through the esophageal opening were not sufficient to warrant surgical treatment. About two years later the patient returned for examination because of dysphagia, and a stricture of the esophagus was found which was believed to be benign. In another case there was cardiospasm associated with hernia of a portion of the stomach through the diaphragm.

Patients who complain of dysphagia, irrespective of the presence of certain neurotic manifestations, should be studied carefully with

9. Winkelstein, A.: Peptic Esophagitis: A New Clinical Entity, J. A. M. A. **104**:906 (March 16) 1935.

10. Vinson, P. P., and Moersch, H. J.: Para-Esophageal Diaphragmatic Hernia Associated with Intrinsic Lesions in the Esophagus: Report of Cases, Arch. Otolaryng. **21**:437 (April) 1935.

the view of ruling out organic disease of the esophagus. While the diagnosis can be made on the basis of the history, general examinations and roentgen studies, Equen [11] stated, in agreement with other writers, that esophagoscopy is indicated if there is a question of disease of the esophagus. Removal of a biopsy specimen is a safe procedure and should be carried out whenever indicated. He condemned the blind passage of bougies.

Cicatricial Stricture.—The report of a case by Pitkin [12] of stricture of the esophagus due to the accidental administration of lactic acid is worthy of comment. Lactic acid is commonly employed by pediatricians for the acidification of milk in infant feeding. It has also been used as a caustic agent in the treatment of ulcers, notably in cases of tuberculosis. In the case reported an infant aged 11 weeks was being fed a formula which was acidified with lactic acid. Bottles were mixed, and a large dose of lactic acid was given by mistake. Three weeks later the infant exhibited marked dysphagia. A diagnosis of cicatricial stenosis was made, and gastrostomy ultimately became necessary. Retrograde dilation gave a satisfactory result. It is important in this connection to emphasize the fact that lactic acid, which is used extensively in infant feeding, should be kept in properly labeled containers, and users should be duly cautioned.

In a report on a group of cases of cicatricial stenosis of the esophagus caused by the swallowing of chemical escharotics, Kearney [13] gave a report of the case of a child who swallowed sulfuric acid. Tracheotomy was necessary for relief of the obstructive laryngeal dyspnea, and gastrostomy was performed for feeding purposes. Retrograde bougienage was instituted, and a satisfactory result was secured. In another case carcinoma developed at the site of an esophageal stricture forty-one years after the patient had swallowed lye.

In a survey of the incidence of esophageal strictures resulting from caustic alkalis Taylor [14] stated that he was impressed with the fact that there has been a definite decrease in the number of cases of lye burns. It was observed that there has been more than a 50 per cent decrease in the number of these accidents in certain states since the legislation with regard to lye went into effect, in spite of the fact that the use of caustic alkalis has increased enormously during this interval. A number

11. Equen, M.: Esophageal Obstruction: Diagnosis and Treatment, South. M. J. **28**:1103 (Dec.) 1935.

12. Pitkin, C. E.: Lactic Acid Stricture of the Esophagus, Ann. Otol., Rhin. & Laryng. **44**:842 (Sept.) 1935.

13. Kearney, H. L.: Unusual Cases of Cicatricial Stricture of the Esophagus, Ann. Otol., Rhin. & Laryng. **44**:527 (June) 1935.

14. Taylor, H. M.: A Preliminary Survey of the Effect Which Lye Legislation Has Had on the Incidence of Esophageal Stricture, Ann. Otol., Rhin. & Laryng. **44**:1157 (Dec.) 1935.

of new caustic preparations, such as drain pipe cleaners and paint removers, have been added. He emphasized the importance of maintaining interest in this subject both from a humane and from an economic standpoint and commended the Committee on Lye Legislation.

Benign Tumor of the Esophagus.—The relative rarity of benign tumor of the esophagus and a lack of distinctive clinical and roentgenologic features render diagnosis difficult. A benign tumor can be accurately distinguished only by esophagoscopy and biopsy. A case of adenoma of the esophagus, occurring in a man aged 48, has been reported by Moersch and Broders.[15] The chief complaint was dysphagia, although there was a history of a sense of burning in the epigastrium from twenty to thirty minutes after meals for two years previously. Dysphagia was more recent. Roentgen studies revealed a narrowing at the lower end of the esophagus that was not characteristic. At esophagoscopy an obscure flat mass was observed in the lower part of the esophagus. There was no ulceration or bleeding. Tissue removed for biopsy exhibited only an inflammatory mucosa. Because of the presence of obstruction, dilation of the esophagus was carried out. Later a second esophagoscopy was performed to determine the accurate nature of the lesion. Additional tissue was removed, which was diagnosed as adenomatous. It is interesting to note that subsequent roentgen study of the stomach and duodenum in this case revealed a duodenal ulcer.

Malignant Tumor of the Esophagus.—Inaccessibility of the esophagus to surgical treatment cannot be accepted as the real reason for a practically 100 per cent mortality from cancer of the esophagus. Jackson[16] expressed the opinion that failure to make a diagnosis early is largely responsible for this mortality. The chief reasons are that all the diagnostic methods enumerated in textbooks, particularly the evaluation of the history of the case, the interpretation of disturbances in swallowing and the blind passage of a bougie, give either negative or inconclusive information during the early stages of the disease. Little progress in this field can be hoped for until in every case in which there is the slightest disturbance referable to the throat and swallowing a roentgen study of the swallowing function and diagnostic esophagoscopy are carried out.

The diagnosis of carcinoma of the esophagus is made practically always when the disease is advanced. In a clinicopathologic study of

15. Moersch, H. J., and Broders, A. C.: Adenoma of Esophagus, Arch. Otolaryng. **21**:168 (Feb.) 1935.

16. Jackson, C.: Carcinoma and Sarcoma of the Esophagus, South. Surgeon **4**:1 (March) 1935.

primary esophageal carcinoma based on 108 necropsies, Mathews and Schnabel [17] directed attention to a nonstenosing variey of growth that was noted in 22 cases (20.3 per cent). Investigation of the clinical features disclosed that the complaints in these cases were loss of weight, pains in the chest, cough, hoarseness, weakness and vomiting. Dysphagia was an infrequent symptom, in contrast to its frequent occurrence in the cases in which stenosis was present. It is of interest to note that diagnostic esophagoscopy was performed in only 23 of the entire group of cases. In 21 the clinical and the roentgenographic diagnoses of cancer were corroborated. All the nonstenosing growths were found to involve the lower two thirds of the thoracic portion of the esophagus. Like other writers, Mathews and Schnabel emphasized the importance of esophagoscopy in all cases in which carcinoma is suspected, with removal of properly selected tissue for biopsy.

In the treatment of carcinoma of the esophagus with radon seeds implanted through the esophagoscope Steele [18] expressed the opinion that combined irradiation from above and below is a step in advance of the more or less empirical procedure of introducing the radon seeds from above only. The introduction of the radon seeds from below is carried out by retrograde esophagoscopy. Steele expressed the belief that the use of radon seeds combined with high voltage roentgen therapy appears to have distinct possibilities.

Intubation of the Esophagus.—The problem of studying the esophagus in cases of deformity of the spine was discussed by Mosher,[19] who reported a case of intubation of the esophagus performed under such conditions. In his patient the esophagus, which was markedly bent, owing to tuberculosis of the spine in childhood, was found to be movable and could be brought into a straight line for the passage of bougies. At the second attempt by fluoroscopic bougienage the stomach was entered. Retrograde bougienage was carried out, but there was no improvement in swallowing. Intubation was therefore carried out. Owing to the curvature of the spine the intubation tube did not lie on a flat bed, and the possibility of injury resulting from pressure had to be considered. After the second insertion of the intubation tube coughing became troublesome, and the tube was removed. Later there was fever. The patient's condition became progressively worse, and she died as a

17. Mathews, R. W., and Schnabel, T. G.: Primary Esophageal Carcinoma, with Especial Reference to a Nonstenosing Variety, J. A. M. A. **105**:1591 (Nov. 16) 1935.

18. Steele, G. H.: Retrograde (Transgastric) Oesophagoscopy for Carcinoma of Oesophagus, Brit. M. J. **2**:63 (July 13) 1935.

19. Mosher, H. P.: A Case of Intubation of the Esophagus, Ann. Otol., Rhin. & Laryng. **44**:847 (Sept.) 1935.

result of the respiratory condition. At autopsy a fistula was observed extending through the trachea to the esophagus.

Complications Following Esophagoscopy.—The development of spontaneous pneumothorax following esophagoscopy without evidences of mediastinitis suggests rupture of an emphysematous air vesicle, injury to the visceral pleura by a torn pleural adhesion, rupture of a caseous tubercle beneath the pleura or injury to the esophageal wall. Carroll [20] discussed the types of spontaneous pneumothorax, the symptomatology, the diagnosis and the treatment and reported 2 cases in which pneumothorax followed uncomplicated esophagoscopy. In 1 case there was displacement of the upper half of the esophagus without, however, any evidence of endo-esophageal disease. In both cases pyothorax subsequently developed.

Carmody [21] expressed the opinion that esophageal accidents are usually due to haste or to defective judgment. With the development of more modern methods of diagnosis and direct examination of the food passages and with the discontinuance of blind methods of instrumentation, with stomach tubes, hooks and probangs, there should be little reason for these accidents. A report of 8 cases is appended.

BRONCHOSCOPY

Diagnostic Bronchoscopy.—In the earlier days of bronchoscopy hemoptysis usually was considered a contraindication to bronchoscopy. While a recent large hemorrhage should be a contraindication to immediate bronchoscopic investigation, bronchoscopy ultimately should be carried out if the cause of the bleeding cannot be determined.

In cases of hemoptysis there is often no evidence by physical examination or roentgen study to permit of a diagnosis. A lack of knowledge of the source of bleeding renders treatment difficult. Gerlings [22] stated that bronchoscopy as a diagnostic procedure is indicated, in fact is indispensable, in certain cases of hemoptysis of unknown origin and noted that dilated veins or the presence of a small tumor that does not give rise to physical signs may be the cause of bleeding. In carcinoma of the bronchus hemoptysis is an early symptom. Recognition of the disease usually can be accomplished only by bronchoscopy. The author stressed the importance of this procedure and emphasized that early diagnosis would favorably affect the results of treatment.

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20. Carroll, G. G.: Spontaneous Pneumothorax Coincident with Esophagoscopy, Arch. Otolaryng. **21**:515 (May) 1935.

21. Carmody, T. E.: Esophageal Accidents, Ann. Otol., Rhin. & Laryng. **44**: 1162 (Dec.) 1935.

22. Gerlings, P. G.: Bronchoscopy in Hemoptysis, Nederl. tijdschr. v. geneesk. **79**:4254 (Sept. 7) 1935.

Hemoptysis of tracheal origin may occur in syphilis, tuberculosis and carcinoma as well as in certain other localized lesions, such as papilloma, angioma, varices and benign ulcers. These conditions are usually localized and well defined and can be seen readily on direct examination. In addition to these, Mounier-Kuhn [23] has described a condition which he has designated hemorrhagic tracheitis. In this condition the clinical findings are often identical with those in cases of hemoptysis due to other causes. It is important to rule out tuberculosis as the cause of hemoptysis by all known diagnostic methods. In the event that tuberculosis is not found endoscopic studies are indicated. The findings in hemorrhagic tracheitis are hyperemia and thickening of the tracheal mucosa with obliteration of the normal tracheal landmarks. The application of cocaine and epinephrine usually does not clear up the congestion. There is a tendency for the mucous membrance to bleed readily when touched with the tip of the bronchoscope. In none of these cases has ulceration been observed. The changes in this condition are limited almost entirely to the trachea and the larger bronchi. The etiology is obscure. In a few cases the author was able to find the spirochete of Castellani.

Benign Tumor of a Bronchus.—Although the literature leads one to believe that benign new growth of a bronchus is uncommon, in the experience of Morlock and Pinchin [24] a large number of cases have been noted. In the past four and one-half years 9 benign, or supposedly benign, growths were found bronchoscopically in 150 cases of bronchial neoplasm. This gives an incidence of 6 per cent. The authors stated that the presence of a growth should be recognized promptly and that the tumor should be removed in order to prevent the permanent damage to the lungs which results from prolonged bronchial obstruction. The records of 9 cases of benign bronchial neoplasm were published.

Miller [25] has reported the case of a woman aged 23 years who had obstructive atelectasis of the upper lobe of the left lung. At bronchoscopy a soft tumor was observed blocking the orifice of the bronchus to the upper lobe. The histologic picture showed an epithelial tumor, the cells being in rows without distinct glandular arrangement and many blood vessels being present. A second bronchoscopy was necessary so that the remaining portions of tumor could be removed, although improvement was steady after the first examination.

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23. Mounier-Kuhn, P.: Hemorrhagic Tracheitis: A Study of Tracheal Hemorrhage, Arch. ital. per le mal. d. trachea-bronchi, esophago **13**:50 (Jan.) 1935.

24. Morlock, H. V., and Pinchin, A. J. S.: Benign Neoplasms of Bronchus, with Records of Nine Cases, Brit. M. J. **2**:332 (Aug. 24) 1935.

25. Miller, J. W.: Noncancerous Epithelial Tumor Obstructing the Bronchus of the Upper Lobe of the Left Lung, Arch. Otolaryng. **21**:703 (June) 1935

The case of an adenomatous polyp in the right main bronchus of a boy aged 11 years was reported by Rosenblum and Klein.[26] The physical findings were those of obstructive atelectasis involving the lower lobe of the right lung. The roentgen findings showed a triangular basal shadow. At bronchoscopy the tumor was observed in the main bronchus of the right lung just beyond the bifurcation of the trachea. It was attached by a thin pedicle. After removal of the mass roentgen studies made following the instillation of iodized poppy-seed oil exhibited marked bronchiectasis of the lower lobe of the right lung. The patient's condition improved rapidly, and two months later the triangular basal shadow had almost disappeared.

A series of 23 cases of adenoma of a bronchus have been reported by Kramer and Som.[27] Seventeen of the patients were alive, and 14 were pursuing a normal active life, the average period of observation following the institution of treatment being four years. Hemoptysis, cough and certain asthmatoid symptoms were commonly observed. The presence of bronchial obstruction ultimately led to chronic suppuration, with bronchiectasis distal to the obstruction. In all the cases bronchoscopic removal with cutting instruments was performed first. Then other measures, notably implantation of radium or radon packs and roentgen therapy, were employed. The authors stated that it was their impression that external roentgen therapy did not contribute to the destruction of the lesion. In all cases in which the growth could not be removed bronchoscopically, roentgen therapy was employed without benefit. Emphasis was placed on the recognition of the benignity of the tumor. In some of their earlier cases the tumors were considered to be malignant.

Benign, or so-called carcinoid, bronchial tumors are commonly found in the larger bronchi. In Kernan's[28] experience the bronchoscopic appearances were found to be characteristic. The tumor is rather soft, giving a suggestion of being pedunculated, and may often move with respiration. The wall of the bronchus is not fixed or indurated and permits of respiratory movement. The tumor itself is vascular and bleeds readily when touched with instruments or when a biopsy specimen is taken. In Kernan's experience treatment depended on the size of the growth. In certain instances the taking of a specimen was sufficient to check the growth of the tumor. He found that diathermy had been most successful in his hands. A detailed report of 10 cases was included.

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26. Rosenblum, P., and Klein, R. I.: Adenomatous Polyp of the Right Main Bronchus Producing Atelectasis, J. Pediat. **7**:791 (Dec.) 1935.

27. Kramer, R., and Som, M. L.: Further Study of Adenoma of the Bronchus, Ann. Otol., Rhin. & Laryng. **44**:861 (Sept.) 1935.

28. Kernan, J. D.: Treatment of a Series of So-Called Carcinoid Tumors of the Bronchi by Diathermy: A Report of Ten Cases, Ann. Otol., Rhin & Laryng. **44**:1167 (Dec.) 1935.

Malignant Tumor of the Trachea and Bronchus.—In a case of carcinoma of the trachea reported by Stenn,[29] occurring in a man aged 55, the symptoms were largely those of esophageal disease, as the patient was unable to swallow solid food and had difficulty in swallowing liquids. At bronchoscopy a large cauliflower-like mass was observed on the posterior wall of the trachea. At esophagoscopy marked narrowing of the esophageal lumen was seen at the level of the suprasternal notch, but there was no evidence of an endo-esophageal neoplasm. Although the tumor disappeared after high voltage roentgen therapy, the patient died. At autopsy extensive ulceration and necrosis of the trachea, with perforation into the esophagus and the development of lobar pneumonia, were present.

In an analysis of 31 cases of carcinoma of the bronchus, Lloyd[30] stated that bronchoscopy ranks first among the specialized methods of diagnosis. He found, however, that in 35 per cent of his cases the growth originated in one of the small bronchial subdivisions or in the parenchyma of the lung, with the result that bronchoscopy was of little value diagnostically. The injection of an opaque substance into the tracheobronchial tree may show obstruction or deformity of the tracheal or bronchial lumen. This method, however, should never be used as a substitute for bronchoscopy. In 24 of Lloyd's 31 cases a bronchoscopic examination was made, and in 17 cases a satisfactory specimen was secured for biopsy. In the remaining 7 cases the tissue either gave inconclusive information or was normal, even though in some instances the presence of malignancy was demonstrated clinically.

In a report of 21 cases of primary new growth of the lung, Orton[31] stated that he was in accord with the opinion of bronchoscopists concerning the importance of close cooperation with the roentgenologist, the pathologist and the thoracic surgeon, from the standpoint of diagnosis and of determining the most beneficial form of treatment. The outstanding symptoms in his group of cases were pain in the chest, cough, dyspnea and hemoptysis.

Hemoptysis is considered as a common and relatively early symptom of bronchial carcinoma. The amount expectorated is usually small. In cases of bronchiectasis, pulmonary tuberculosis and certain benign growths hemoptysis is an indication for immediate bronchoscopy. In the case reported by Lederer[32] severe hemorrhages had occurred. All

29. Stenn, F.: Carcinoma of the Trachea, Arch. Otolaryng. **21**:190 (Feb.) 1935.

30. Lloyd, M. S.: The Early Classification and Early Diagnosis of Cancer of the Bronchus, New England J. Med. **213**:101 (July 18) 1935.

31. Orton, H. B.: Primary Carcinoma of the Lung, J. M. Soc. New Jersey **32**:635 (Nov.) 1935.

32. Lederer, F. L.: Hemorrhage in Lung Cancer: A Fatal Case Following Bronchoscopy, Ann. Otol., Rhin. & Laryng. **44**:157 (March) 1935.

of the findings indicated that there was a lesion in the lower lobe of the right lung. At bronchoscopy there was found a growth in the right bronchus. Although the bleeding was profuse, tissue was secured and proved to be adenocarcinomatous. In a case of fatal hemorrhage from the lung after bronchoscopy it was noted at autopsy that the pulmonary vein in the upper lobe of the right lung presented an irregular tear which communicated with the tumor in the middle lobe and the adjacent portion of the upper lobe. There was definite softening of the vessel wall secondary to similar changes in the tumor mass.

In a case of adenocarcinoma of the bronchus reported by Moersch and Bowing [33] the growth was located at the lower end of the trachea. There was marked dyspnea. After destruction of a portion of the tumor by surgical diathermy through the bronchoscope immediate relief was secured. Two additional treatments were required, together with two courses of roentgen therapy. At the time of their report, twenty-two months after the first bronchoscopy, the patient was in normal health. The writers emphasized the importance of bronchoscopy in any case in which there are indefinite pulmonary symptoms with or without positive roentgen findings; bronchoscopy is the only means by which a small or early lesion of the bronchial wall can be discovered.

Pulmonary Atelectasis.—Pulmonary atelectasis following hemoptysis in tuberculosis undoubtedly occurs more often than the reports in the literature would suggest. In Heaton's [34] case the occurrence of dyspnea with roentgen findings of displacement of the heart to the right and atelectasis of the lower lobe of the right lung following hemoptysis indicated the presence of bronchial obstruction. At bronchoscopy many blood clots in the form of bronchial casts were removed from the right bronchus, and afterward there was prompt reexpansion of the lung, with relief of dyspnea. Collapse recurred six weeks later, again involving the lower lobe of the right lung. Relief was secured promptly after bronchoscopic removal of the blood clots. Curiously, the diagnosis of tuberculosis could not be corroborated in this case. The writer emphasized the importance of considering bronchoscopy in cases in which expectant treatment is ineffective.

According to Butler,[35] the occurrence of postpneumonic atelectasis with empyema predisposes to chronicity of the empyema unless the atelectasis is relieved. This condition commonly paves the way for

33. Moersch, H. J., and Bowing, H. H.: Primary Carcinoma of the Bronchus Treated Successfully with Surgical Diathermy, Ann. Surg. **102**:989 (Dec.) 1935.

34. Heaton, T. G.: Pulmonary Atelectasis Resulting from Haemoptysis, Canad. M. A. J. **32**:409 (April) 1935.

35. Butler, E. F.: Postpneumonic Atelectasis Complicating Postpneumonic Empyema, Ann. Otol., Rhin. & Laryng. **44**:855 (Sept.) 1935.

pulmonary fibrosis and the type of chronic empyema that can be cured only by extensive thoracoplasty. Such atelectasis should be suspected whenever postpneumonic empyema fails to clear up within a reasonable time and no satisfactory explanation can be found. Bronchoscopic examination for diagnosis and endobronchial aspiration and manipulation for treatment are the procedures of choice. There is therefore a two-fold reason for advising bronchoscopic examination in all cases in which atelectasis is suspected. A case of postpneumonic empyema was reported in which atelectasis was suspected, but certain factors made it advisable to postpone bronchoscopy. As no improvement was noted following palliative measures, bronchoscopic examination was later carried out. Within a few hours the patient felt that he could breathe more freely. Definite improvement was noted on fluoroscopic examination, and recovery was ultimately obtained.

Tuberculosis.—Bronchoscopy is not indicated in the average case of uncomplicated pulmonary tuberculosis, but the development of certain signs or symptoms indicating the presence of bronchial obstruction usually warrants bronchoscopic investigation to ascertain the cause, so that appropriate treatment may be carried out. In Ballon's [36] cases a diagnosis of tuberculosis had been made previously. With the development of symptoms suggesting asthma bronchoscopy was performed. In 1 case marked stenosis was noted in the bronchus of the lower lobe of the right lung. Repeated bronchoscopic dilation was followed by striking improvement in the patient's condition, with amelioration of the symptoms. In the second case an irregular mass of tissue almost completely occluded the left main bronchus. After its removal temporary improvement was noted. At subsequent bronchoscopies, performed because of recurrence of symptoms, granulation tissue was found, but to a lesser degree. Although allergic studies may be indicated when a tuberculous patient shows asthmatic symptoms, one should always consider the possibility of bronchial obstruction and the need of bronchoscopic investigation.

Among the indications and contraindications for bronchoscopy in tuberculosis Lasagna [37] considered as most important the state of the nervous system, which is greatly altered in the tuberculous person. The patients examined by him presented various signs and symptoms, such as tuberculoma, fibrosis and cicatrices, ulceration of a bronchus and hemoptysis. In none were there any untoward effects, and in a number information was secured which favorably influenced the sub-

36. Ballon, D. H.: Bronchoscopy in the Diagnosis of Asthma Complicating Pulmonary Tuberculosis, J. Thoracic Surg. **5**:103 (Oct.) 1935.

37. Lasagna, F.: Bronchoscopy in Tuberculosis, Arch. ital. per le mal. d. trachea-bronchi, esophago **13**:102 (April) 1935.

sequent progress. In his opinion it is important to overcome the apprehension concerning bronchoscopy that commonly exists among these patients.

Pulmonary Suppuration.—Additional evidence favoring aspiration as an etiologic factor in pulmonary infection has been given in a report of studies carried out by Lowenthal.[38] In a review of the literature on aspiration of secretions and pharyngeal contents into the tracheobronchial tree he found that practically all observations had been made on patients following operation on the pharynx or on parts draining into or adjoining the pharynx. In order to eliminate two factors which might influence the aspiration of secretions, namely, the effects of bleeding in the operative field, with a resulting increase in the pharyngeal content, and the effect of instrumental depression of the tongue, as in tonsillectomy, Lowenthal carried out his investigations on 21 patients following operations other than those on the upper respiratory or food passages. Bronchoscopy was performed immediately after operations done with the patient under ether anesthesia. It was found that aspiration of pharyngeal content into the tracheobronchial tree occurred in 76 per cent of the 21 cases studied. Lowenthal concurred in the view held by many observers that aspiration is important as an etiologic factor in postoperative pulmonary complications and also that it may be operative in cases in which the operation is not on the pharynx, mouth or nose. He suggested frequent suction as a means of decreasing the quantity of pharyngeal secretions subject to aspiration.

Pulmonary Abscess.—Considerable difference of opinion exists as to the frequency with which an acute pulmonary abscess clears up under medical treatment combined with postural drainage. The figures vary from 10 to 60 per cent. Whatever the figures may be, Pinchin and Morlock [39] stated that they were convinced that all measures which will aid in a prompt resolution should be employed. They expressed the belief that bronchoscopic drainage is often successful in causing resolution in the early stages, during the period of pneumonitis. Waiting to determine if an incipient abscess will undergo resolution is to risk the development of a large abscess, whereas no harm can come from bronchoscopic treatment, and if it is successful the patient may be spared the necessity of a serious operation. For effective bronchoscopic drainage skilled technic is necessary. The drainage tube must be inserted into the bronchus draining the abscess. The authors stated that the bronchoscope as an accessory in the treatment of abscess of the lung

38. Lowenthal, G.: Tracheobronchial Aspiration of Buccopharyngeal Secretion During Ether Anesthesia, Arch. Otolaryng. **21**:561 (May) 1935.

39. Pinchin, A. J. S., and Morlock, H. V.: Further Observations on Lung Abscesses and Their Treatment, Lancet **1**:1369 (June 15) 1935.

had not received its due in England. The reason is not far to seek. The physician who has the greatest interest in following these cases medically has not had any experience with this instrument; the laryngologist has slight acquaintance with the lungs and no opportunity of following the disease, while the surgeon tends to prefer the knife. The authors expressed the opinion that every patient with an abscess of the lung should be watched and treated bronchoscopically so that if an operation is necessary it may be undertaken at the optimum period. Each case must be considered with an open mind, and enthusiasm for this method must not lead one to continue its use when experience has shown that an open operation is desirable.

In a presentation of endoscopic work done during the past five years, covering a total of 308 endoscopic examinations and treatments, Knight [40] stated that he was in agreement with bronchoscopists concerning the importance of familiarity with the indications for bronchoscopy in pathologic conditions other than those caused by a foreign body. He reported his results with bronchoscopic treatment in cases of pulmonary abscess, pulmonary atelectasis and other bronchial lesions together with a group of 42 cases of foreign bodies in the air and food passages.

The value of endoscopic methods of treatment was discussed by Kernan,[41] who recounted personal experiences to emphasize the importance of this subject. He strongly urged prompt bronchoscopic measures for abscess of the lung after tonsillectomy or nasal operations and discussed several cases in which such treatment was immediately followed by recovery. His experiences with the use of the bronchoscope in cases of bronchiectasis were not so satisfactory, although in 1 case dilation of a bronchial structure was followed by considerable improvement.

In recording his experiences in the employment of bronchoscopic treatment of pulmonary abscess, Soulas [42] has been impressed by the fact that it is far more useful against the acute than against the chronic forms of suppuration. He has secured a cure in about 50 per cent of the cases of acute abscess, whereas in cases of chronic abscess cure resulted in about 15 per cent. Usually from 3 to 6 bronchoscopic treatments are necessary before one can arrive at any conclusions regarding their value. Subsequent treatment is dependent on the clinical progress and on the roentgen and bacteriologic findings. The difficulties encoun-

40. Knight, J. S.: Bronchoscopy: Some Observations with Case Presentations, J. Missouri M. A. **32**:264 (July) 1935.

41. Kernan, J. D.: Endoscopy in the Treatment of Diseases of the Upper Respiratory Tract, Laryngoscope **45**:499 (July) 1935.

42. Soulas, A.: Bronchoscopy in the Treatment of Chronic Abscess of the Lung, Arch. ital. per le mal d. trachea-bronchi, esophago **13**:85 (April) 1935.

tered in the treatment of chronic abscess are the result of alterations in the bronchial and peribronchial tissues, with pulmonary fibrosis.

Looper [43] said that he agreed with many bronchoscopists that bronchoscopy is indicated in the treatment of abscess of the lung, particularly when the abscess communicates with a bronchus. The peripherally located abscess obviously requires surgical drainage. When the presence of one or multiple abscess cavities contraindicates surgical drainage, bronchoscopic aspiration is of value.

While satisfactory results were secured by bronchoscopic treatment in certain cases of chronic abscess of the lung, Rist and Soulas [44] urged that these should not be accepted as criteria in selecting cases in which bronchoscopic treatment is to be used. They secured remarkable results when the treatment was instituted early, within the first three or four weeks after the development of an abscess. With 1 exception the total number of bronchoscopic treatments given these patients did not exceed 9. Definite clinical improvement was noted after the fifth or sixth treatment. If improvement could not be secured promptly, external drainage was advised. Their endobronchial procedures varied greatly, depending on the findings. The authors stressed the importance of endobronchial therapy for relief of congestion of the mucosa and recommended the use of epinephrine after the instillation of a cajuput oil from Melaleuca viridiflora.

Bronchoscopic observations in a case of pulmonary dermal inclusion cyst were reported by Beck,[45] who cooperated with the thoracic surgeon to determine the cause of expectoration of excessive amounts of foul pus after an operation for empyema. At the second operation it was necessary to resect a large portion of the middle lobe of the right lung. Beck stated that it was his opinion that the cavity in the middle lobe was lined with epithelium of dermal origin, and this opinion was verified histologically. The cyst apparently resulted from one of the skin flaps which joined the mucous membrane of the bronchus in forming a bronchial fistula and which subsequently was shut off by cauterization through the external fistula.

Bacteriophage Therapy.—In a preliminary report on the use of polyvalent staphylococcus bacteriophage Moore and Love [46] stated that they

43. Looper, E. A.: The Use of Bronchoscopy in Pulmonary Disease, South. M. J. **28**:419 (May) 1935.

44. Rist, E., and Soulas, A.: Cases of Pulmonary Abscess Treated and Cured by Bronchoscopic Therapy, Bronchoscop., œsophagoscop. et gastroscop., October 1935, p. 289.

45. Beck, J. C.: Bronchoscopy in a Pulmonary Dermal Inclusion Cyst, Ann. Otol., Rhin. & Laryng. **44**:1159 (Dec.) 1935.

46. Moore, W. F., and Love, J. W.: A Preliminary Report on the Clinical Application of a Polyvalent Staphylococcus Bacteriophage in Bronchoscopy, Am. J. M. Sc. **189**:91 (Jan.) 1935.

employed a commercial phage in a group of 10 cases and a special phage prepared by themselves in 18 cases. The 28 patients treated included 14 with bronchiectasis, 10 with pulmonary abscess and 3 with chronic bronchitis. Of the 10 treated with the commercial phage, 4 showed improvement, 6 were unimproved and 1 died of intercurrent pulmonary hemorrhage. Of the 18 treated with the special phage, all but one showed improvement after 2 or more bronchoscopic instillations. Two were discharged apparently cured. The technic employed was the same as that used in the bronchoscopic treatment of pulmonary suppuration. Pus was thoroughly aspirated, and mechanical obstruction to drainage was removed when present. Five cubic centimeters of bacteriophage was then injected directly into the bronchus, which had previously been cleared by aspiration. Efforts were made to have the patient check coughing as long as possible. The authors stated as their conclusion that the active polyvalent staphylococcus bacteriophage which they prepared was of apparent value when applied bronchoscopically in the treatment of bronchopulmonary suppuration.

Iodism.—The use of iodized poppy-seed oil for bronchography has now become so much a part of the routine investigation of nontuberculous diseases of the chest that the occurrence of severe complications should be recorded. Two cases, 1 of which proved fatal, were described by Scadding.[47] Practically three thousand pneumonographic examinations had been carried out without a previous serious accident. The fatality occurred after the introduction of 20 cc. of iodized poppy-seed oil 40 per cent. Six hours after the injection evidence of acute iodism developed. There was marked coryza with nosebleed, salivation and injection of the conjunctiva. Two days later the symptoms became markedly aggravated, and rather marked urticaria, subcutaneous hemorrhages and marked dyspnea were noted. Difficulty in swallowing resulted from a greatly swollen tongue. The patient died from exhaustion and pulmonary edema fifty-four hours after the injection of iodized oil.

In the second case, that of a woman aged 59 years, iodized poppy-seed oil had been injected in 1930 for diagnostic purposes. A second injection of iodized oil in 1934 was followed within six hours by acute symptoms. These symptoms gradually became worse, and the patient was given hypertonic saline solution and a 5 per cent solution of dextrose intravenously. She made a slow recovery and was unable to leave her bed for four weeks. The accidental introduction of the iodized oil into the stomach is believed to be a necessary antecedent for the toxic symptoms, but in neither of these cases was any oil found in the stomach by roentgen examination.

47. Scadding, J. G.: Acute Iodism Following Lipiodol Bronchography, Brit. M. J. **2**:1147 (Dec. 22) 1934.

FOREIGN BODIES IN THE AIR AND FOOD PASSAGES

Bacteriologic Study.—The pathologic changes which develop in the lung after the aspiration of a foreign body are dependent on the character of the aspirated object, the degree of obstruction to the airway and the type of pathogenic bacteria present either distal to or at the site of lodgment of the foreign body. Bucher's [48] observations were based on a study of secretions removed bronchoscopically in a series of 243 patients with a foreign body in the trachea or bronchus. In his conclusions he expressed the opinion that cultures seeded from pus collected bronchoscopically from the trachea and bronchi furnish more reliable data on the kind of micro-organisms present than those seeded from expectorated material. The bacterial flora present in the air passages in which a foreign body is lodged does not materially change with the type of foreign body, its location or length of sojourn there, the age of the patient or the degree of obstruction induced. Other things being equal, one pathogen seems as capable as another of producing a severe grade of infection in an obstructed tracheobronchial tree. Quantitative differences in the numbers of colonies of different organisms on a plate of blood agar seeded from pus recovered from these lesions are a reliable guide in estimating the part that a given organism plays in the resulting infection. The indications from a limited number of studies of the anaerobic bacteria from such lesions are that they are of minor importance. The bacterial invasion and infection of the tissues of the lower respiratory tract at the site of a foreign body seem to follow the same general principles as those encountered with obstructive lesions elsewhere in the body. The irritation produced by the obstructing body itself and the amount of hindrance to drainage, primarily, and, secondarily, other factors favoring or hindering microbic multiplications, such as the age and hardihood of the tissues, pressure on them and the duration of the irritation, determine and limit the infection.

Mechanical Problems.—For successful treatment in these cases a knowledge of the mechanical problems involved is fundamental. The aspiration of a staple or double-pointed tack into the air passages is not as uncommon as the medical literature indicates. In a presentation of this subject, particularly from the standpoint of the mechanical problems involved in the removal of a foreign body of this type, the Jacksons [49] emphasized the importance of carelessness as an etiologic factor.

48. Bucher, C. J.: The Bacterial Flora Associated with Foreign Bodies in the Trachea and Bronchi, Am. J. M. Sc. **190**:409 (Sept.) 1935.

49. Jackson, C., and Jackson, C. L.: Staples and Double-Pointed Tacks as Foreign Bodies: Mechanical Problems of Bronchoscopic Extraction, Arch. Otolaryng. **22**:603 (Nov.) 1935.

The pathologic changes in the lung are dependent on the degree of obstruction produced. When a nail or tack is first aspirated the local reaction is moderate, as the foreign body is metal and not obstructive. Changes in the foreign body, the result of corrosion, produce infection of the bronchial wall, with obstruction to ventilation and drainage. The resulting symptoms and physical signs are commonly observed in cases of pulmonary suppuration with bronchial obstruction.

The fundamental principle involved in dealing with a foreign body of this type is that an advancing point perforates whereas a trailing point is relatively harmless. The Jacksons have worked out methods of handling a double-pointed object that are almost always successful and which when used with care practically eliminate all danger to the life of the patient. The aspirated objects can be divided into two classes, namely, the bendable and the unbendable. The latter group present the more difficult problems in removal. The mechanical problems involved and the special instruments required were discussed by the authors. Tabulated information covering a group of 33 cases in which a double-pointed object was removed by the peroral route from the bronchi, esophagus or stomach was appended.

The presence of a portion of a surgical instrument as a foreign body in the air or food passages may result from the use of poor or improper material, from defective designing or from improper tempering of steel instruments. In discussing this problem the Jacksons [50] considered the subject broadly from the standpoint of the manufacture and tempering of instruments and their subsequent care in the operating room. Ten cases in which a surgical instrument was the foreign body were reported and discussed with special reference to the etiologic factors. The legal liability from the surgeon's standpoint is dependent largely on the prompt care of the patient's best interests. If there is breakage and loss of a part of an instrument that becomes a foreign body the surgeon should at once inform the patient and have a roentgenogram made so that endoscopic removal may be effected without delay. The surgeon is not liable for the mere accident of breakage, but he is liable for negligence if he fails to take prompt and proper steps to guard his patient's health.

Foreign Body in the Air Passages.—In presenting a group of cases of watermelon seed in the air passages with removal by means of the bronchoscope, Alcantara and de Ocampo [51] said that they wished to bring to the attention of the medical profession, particularly practicing

50. Jackson, C., and Jackson, C. L.: Faulty Surgical Instruments as a Cause of Foreign Body, Arch. Otolaryng. **22**:293 (Sept.) 1935.

51. Alcantara, V. C., and de Ocampo, G.: Watermelon Seed in the Air Passages: Report of Cases, J. Philippine Islands M. A. **15**:464 (Sept.) 1935.

physicians in their country, certain points to be observed in the diagnosis of foreign body in the air passages. They emphasized certain precautions to be taken in the management of these cases in order to avoid blunders which may prove fatal. They also expressed the belief that it is necessary to disseminate a knowledge of this subject to the laity so that seeds, nuts and other objects that are potential foreign bodies will be kept from children.

In reporting on the successful management of 3 cases of multiple foreign bodies occurring in infants less than 1 year of age Eeman [52] emphasized the danger of undue haste in the removal of a foreign body. He said that, although one should proceed as rapidly as possible, it is of greater importance to make a thorough preoperative preparation. This type of work should never be undertaken by an untrained person. Like other writers, Eeman emphasized the importance of prophylaxis by proscribing the use of safety pins in infants' clothing and never allowing infants to have small objects that can be put into the mouth.

Aspiration of loose teeth by children when under the influence of a general anesthetic, particularly for tonsillectomy, the loss of teeth during dental extraction and aspiration of fillings or dental instruments have been reported in the literature on many occasions. Chamberlin [53] reported a case in which fourteen teeth had been extracted under gas anesthesia. Several days later there was profuse expectoration of pus together with expectoration of a small piece of bone. The patient refused to permit a roentgen study of the chest at that time; later, however, a roentgenogram was made and showed a large molar tooth in the left main bronchus. This was removed bronchoscopically. Chamberlin emphasized the importance of roentgen examination in all cases of unexplained cough, particularly if this symptom occurs after an operation.

In Vialle's [54] case the foreign body, a key of a clarinet, had lodged in the trachea of a child aged 18 months. Dyspnea was extreme, and asphyxiation seemed imminent. Prompt relief followed the peroral removal of the foreign body. Vialle emphasized the fact that a large foreign body in the trachea is usually more serious than one lodged in a bronchus, because of the danger of asphyxiation.

In compiling data concerning the complications and sequelae in cases of foreign bodies in the air passages it is difficult to secure adequate follow-up data. This is in great part due to the failure on the part of

52. Eeman, F. G.: Cases of Multiple Foreign Bodies in the Air and Food Passages, Bronchoscop., œsophagoscop. et gastroscop., January 1935, p. 56.

53. Chamberlin, W. B.: Removal of Molar Tooth from Left Main Stem Bronchus, Ann. Otol., Rhin. & Laryng. **44**:844 (Sept.) 1935.

54. Vialle, J.: Foreign Body in the Trachea: Removal by Peroral Endoscopy, Bronchoscop., œsophagoscop. et gastroscop., October 1935, p. 355.

patients and physicians to appreciate that pulmonary infection may result from aspiration of a foreign body, even if the foreign body is promptly and carefully removed; moreover, the economic status of the majority of patients who aspirate foreign bodies is not conducive to the maintenance of a settled place of abode. A series of 340 consecutive cases of foreign bodies in the air passages was reviewed. Beans were found to constitute the most serious form of foreign body as far as complications were concerned. Bones in the bronchi, particularly of children, also were associated with severe pulmonary infection. Clerf [55] discussed the frequent occurrence of obstructive dyspnea in cases due to the aspiration of nuts, seeds and shells and the necessity for tracheotomy in certain cases. Attention was directed to the influence of prolonged bronchial obstruction on the development of pulmonary suppuration and the relative frequency of bronchiectasis, which is often overlooked, as patients frequently are discharged from the hospital before the pulmonary tissue has fully recovered. In a number of cases in which an examination was made some time after bronchoscopic removal of a foreign body, with apparent recovery, bronchiectasis was found. Fatalities which resulted in 10 cases were discussed. Immediate complications were observed more often in cases in which a bean was lodged in the air passage; sequelae were noted more commonly in cases in which a head of timothy or a bone was caught in a bronchus.

Lloyd [56] discussed the development of bronchoscopic clinics in small hospitals and emphasized the fundamental principles laid down by bronchoscopists which should be adhered to in order to insure success. Physicians unfamiliar with these principles are often willing to take chances leading to end-results that are serious and often fatal. Lloyd reported 30 cases of foreign bodies in the air and food passages in which endoscopic treatment was employed.

Negus [57] stated that no branch of surgery gives such gratifying results as that of endoscopic removal of foreign bodies from the air and food passages. Lack of correct treatment may be followed by prolonged ill health or death, while removal by suitable methods usually leads to complete recovery. In a majority of cases the prognosis depends in great part on the provision of suitable equipment used with adequate skill. Hasty and ill advised attempts at removal afford almost as serious danger as is provided by the presence of the foreign body itself.

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55. Clerf, L. H.: Foreign Bodies in the Air Passages: Observations on Complications and End Results, Ann. Otol., Rhin. & Laryng. **44**:879 (Sept.) 1935.

56. Lloyd, M. S.: The Development of a Bronchoscopic Service, with a Report of Thirty Cases of Endoscopy for Foreign Bodies, Laryngoscope **45**:633 (Aug.) 1935.

57. Negus. V. E.: Foreign Bodies in the Air and Food Passages, Lancet **2**:730 (Sept. 28) 1935.

Perforating foreign bodies may at times constitute an endoscopic problem. The case of an unusual foreign body in the airway was reported by Berry.[58] Thyroidectomy had been performed eleven months previously. Several months after the operation the patient began to show symptoms referable to the larynx and trachea, characterized by cough and hoarseness. When seen by Berry the patient had coughed up a large piece of cotton, which apparently had been left in the wound and which had ultimately worked its way through the soft tissues and tracheal wall into the trachea. The convalescence was uneventful.

Subcutaneous Emphysema.—Emphysema of the subcutaneous tissues as a complication following bronchoscopic intervention for a foreign body in the air passages undoubtedly occurs more often than the medical literature indicates. In 2 cases reported by Soulas[59] the foreign body was a large, irregular metallic object that had been present in the bronchus for many months. In 1 case the emphysema occurred immediately after bronchoscopy. No complications developed, and recovery was complete. In the fatal case, that of a child aged 30 months, the foreign body, an irregular pocketbook clamp, had been present in the bronchus of the lower lobe of the right lung for nine months. It was embedded in granulation tissue and was complicated by stenosis of the bronchus and atelectasis of the lower lobe.

The mechanism of the production of subcutaneous emphysema without previous operative intervention undoubtedly differs from that resulting after an endoscopic procedure. In a report of 2 cases of extensive subcutaneous emphysema occurring as a complication of a foreign body in a bronchus prior to bronchoscopic intervention, Clerf[60] discussed the mechanism of its occurrence. He also discussed the question of proceeding with the use of the bronchoscope for the removal of the foreign body with a view of preventing further emphysema. The patients, both children, showed extensive emphysema involving the face, neck and upper portion of the chest shortly after choking on a piece of a peanut. The emphysema developed prior to attempts at removal, in fact before it was known that a foreign body was present. Clerf concluded that the fundamental requirement for the production of subcutaneous emphysema complicating bronchial foreign body prior to attempts at removal is rupture of overdistended alveoli, such as

58. Berry, G.: A Perforating Foreign Body of the Trachea, Ann. Otol., Rhin. & Laryng. **44**:838 (Sept.) 1935.

59. Soulas, A.: Remarks on Emphysema of the Neck and Thorax Occurring in Conjunction with Foreign Body in the Bronchus, Bronchoscop., œsophagoscop. et gastroscop., October 1935, p. 338.

60. Clerf, L. H.: Subcutaneous Emphysema as a Complication of Foreign Body in a Bronchus, Ann. Otol., Rhin. & Laryng. **44**:364 (June) 1935.

occurs in obstructive emphysema through an increase in the intra-alveolar tension, as observed in paroxysms of coughing. Air entering a bronchus must be trapped during expiration. The degree and extent of the dissemination of the air in the tissues are dependent on the effectiveness of the valvular action of the foreign body. Prompt removal of the foreign body is indicated to prevent extension of the emphysema and the possible development of complications. The occurrence of mediastinal suppuration results from forcing infected secretions contained in the obstructed bronchus through the ruptured alveoli.

Perforation of the Esophagus.—Esophageal perforation due to a swallowed foreign body probably ranks second in frequency to perforation by carcinoma. It is probable, however, that many cases of perforation by a foreign body pass unrecognized, since the diagnosis is not always easy to make and spontaneous recovery may occur. Three cases were reported recently by McGibbon and Mather.[61] While opinions regarding the proper treatment vary considerably, the authors concluded on the basis of their experience that the use of probangs and coin catchers and all other methods of blind instrumentation should be abolished. In all cases of suspected foreign body in the esophagus esophagoscopy is indicated, even if roentgen studies reveal no abnormality. Patients who exhibit abnormalities of the esophageal mucosa should be kept under observation, the esophagus should be placed at rest and repeated roentgen studies should be made. Subcutaneous emphysema does not demand puncture unless there is evidence of infection. When perforation has been known to be present and septic signs develop, operative treatment is indicated. In all others rest in bed and esophageal rest are indicated.

Foreign Body in the Stomach.—In employing the sheathed flexible gastroscopic forceps devised by Tucker[62] for the removal of gastric foreign bodies, the operator is directed by the roentgenologist after the instrument has been introduced. Tucker emphasized that the instrument should be used by one experienced in endoscopic work and in intra-esophageal manipulations and then only when aided by an expert roentgenologist, since guidance with a biplane fluoroscope is an indispensable part of the technic. Difficulty with gastric folds can be overcome by insufflation of air into the stomach. The writer expressed the opinion that this method, which allows the patient to be rotated safely while under fluoroscopic observation, will permit removal of foreign bodies that would be inaccessible with ordinary gastroscopic methods.

61. McGibbon, J. E. G., and Mather, J. D.: Perforation of Esophagus by Swallowed Foreign Bodies, Lancet **2**:593 (Sept. 14) 1935.

62. Tucker, G.: A New Method of Removal of Foreign Bodies from the Stomach with the Author's Sheathed Flexible Gastroscopic Forceps, J. A. M. A. **105**:1596 (Nov. 16) 1935.

Reports of 2 cases of gastric foreign body in which this method was employed were included.

In discussing the treatment in cases of foreign bodies in the stomach, Clerf [63] emphasized that the majority of foreign bodies that enter the stomach spontaneously are also passed spontaneously through the pylorus. In 818 of 848 cases in which a radio-opaque foreign body was present in the stomach or intestinal canal it was found that the object passed spontaneously. Twelve bodies were removed from the intestinal canal by laparotomy, 1 was removed from the sigmoid flexure by peranal endoscopy and 18 were removed from the stomach by peroral gastroscopy. Gastroscopic removal is indicated if the foreign body cannot leave the stomach; if the object is of such shape or size that it will be unable to pass the turns in the intestine, notably the duodenojejunal junction; if the foreign body is long and pointed, as in the case of needles, or if the swallowed material, such as radium, is toxic. Clerf concluded that a majority of swallowed foreign bodies will pass spontaneously if undisturbed. In questionable cases the opinion of a competent roentgenologist should be secured to determine whether the object can leave the stomach and also whether it will be able to traverse the angulations of the intestinal canal, particularly the duodenojejunal junction. In all cases in which it is believed that the foreign body cannot pass removal should be carried out. The safest and best method of removal of a swallowed foreign body from the stomach is by peroral gastroscopy with roentgenoscopic assistance, a double plane roentgenoscope being used.

INTRATRACHEAL INTUBATION

The opinion has been held generally that no damage to the larynx results from the use of intratracheal intubation tubes for general anesthesia. On theoretical grounds it would seem that the most common complication would be laryngitis, pharyngitis or stomatitis resulting from poor technic, lack of sterility, too tight packing of the throat or manipulations. In a case reported by Gould [64] damage to the larynx did occur. The anesthetic was nitrous oxide, oxygen and ether delivered through a nasal intratracheal tube, which was introduced without difficulty at a stage when the cords were relaxed. After discharge from the hospital the patient complained of involvement of her throat; two months later she had a choking attack, became cyanotic and was unable to breathe properly. By laryngoscopy a growth was found in the subglottic region, and its removal gave complete relief from the

63. Clerf, L. H.: Foreign Bodies in the Stomach, Surg. Gynec. & Obst. **61**:210 (Aug.) 1935.

64. Gould, R. B.: Laryngeal Granuloma Following Intratracheal Intubation, Brit. M. J. **2**:499 (Sept. 14) 1935.

symptoms. The growth recurred, and it was again necessary, about two months later, to remove a small tumor. The pathologic report was that granulation tissue undergoing degeneration was present.

AIDS IN OBSTRUCTIVE DYSPNEA

The use of helium as a new therapeutic gas, based on the conception that its decreased specific gravity in relation to nitrogen would make a helium-oxygen mixture that would be easier to breathe than a comparable nitrogen-oxygen mixture such as air, was proposed by Barach.[65] Since the molecular weight of helium is 4, the substitution of helium for nitrogen with the oxygen concentration of 20 per cent would provide a respirable gas mixture having 33 per cent of the density of air. This mixture was used in the treatment of asthma and in cases of obstructive dyspnea with remarkable results and should be of interest to bronchoscopists. In 4 patients with severe asthma, inhalation of helium-oxygen mixtures appeared to be of considerable benefit. When asthma was continuously present subjective and objective relief was obtained. In 3 patients serious or grave status asthmaticus and refractoriness to epinephrine were removed by inhalation of a helium-oxygen mixture. The acute attack of asthma was not aborted, and the relief obtained by inhalation of various mixtures of helium and oxygen was not sufficient to replace epinephrine when this drug was effective. The special value of helium-oxygen mixtures is in the treatment of asthma persisting after epinephrine and in status asthmaticus. Severe obstructive dyspnea in 2 infants, one with laryngeal and the other with tracheal obstruction, was relieved by inhalation of helium-oxygen mixtures. One of these infants was comfortable in a helium-oxygen tent for eight days, but the congenital nature of the obstruction was such as to require tracheotomy ultimately. In conditions of laryngeal or tracheal obstruction in which there is a possibility that the obstruction will clear up, the inhalation of helium and oxygen may be useful by providing relief from a severe form of air hunger and its consequent fatigue of the respiratory musculature. The relief of dyspnea in patients suffering from various types of respiratory obstruction during the inhalation of helium-oxygen mixtures makes evident the importance of an accustomed volume flow of gas to and from the lungs. This special equilibrium, i. e., the maintenance of a certain required pulmonary air flow, is regulated by proprioceptive reflexes from the lungs and the respiratory musculature. A disturbance in this equilibrium is the primary cause of the sensation of air hunger in association with this type of dyspnea; anoxemia may occur in severe cases as a secondary complicating factor.

65. Barach, A. L.: The Use of Helium in the Treatment of Asthma and Obstructive Lesions in the Larynx and Trachea, Ann. Int. Med. **9**:739 (Dec.) 1935.

Abstracts from Current Literature

Ear

HAEMOLYTIC STREPTOCOCCAL SEPTICAEMIA COMPLICATING MASTOID DISEASE. HILDA STOESSIGER, Proc. Roy. Soc. Med. **27**: 1327 (Aug.) 1934.

A girl of 6 years was admitted to the hospital on April 7, 1934, suffering from headache, fever and a discharging right ear. There was some pain in the left ear. Two days later she had a slight attack of shivering. Paracentesis was performed on the left, with relief of the pain and irritability. The total white blood count was 12,800, with 74 per cent polymorphonuclears. On April 13 a rigor occurred. Blood was taken for a culture, and hemolytic streptococcus was grown. Before the report of the culture was received, polyvalent antistreptococcic (10 cc.) serum and antiscarlatinal serum (20 cc.) were injected. The injection of the latter was repeated at night and for the next three days. No improvement was noticed, and rigors occurred again on April 17 and 18. On April 18 a cortical mastoid operation was performed bilaterally. The right side showed chronic mastoiditis, and there was a bead of pus in the tip of the mastoid process. There were a few granulations on the wall of the lateral sinus; in the left side there was some granulation tissue. Only 10 cc. of antiscarlatinal serum was given in the evening and on the morning following operation. The patient made a rapid recovery, leaving it doubtful whether the serum had been of value in the treatment.

WILLIAMSON, New Orleans. [AM. J. DIS. CHILD.]

THE RESPONSE OF CROSS-EYED PATIENTS TO VESTIBULAR EXAMINATION: NORMALLY INCITED NYSTAGMUS; HYPO-EXCITABILITY OF THE VESTIBULE; ASYMMETRICALLY INCITED NYSTAGMUS. G. JAYLE, Bull. Soc. d'opht. de Paris, February 1935, p. 90.

The response of cross-eyed patients to vestibular examination is relatively little known. Jayle in conjunction with Aubaret and Appaix gave their first report before the Ophthalmological Society of the Southeast. The approved rotatory and caloric tests were made. The results obtained have been interpreted according to the outline given by Baldenweck. Thirty-one cases were studied. They may be divided into three large categories:

1. Normal vestibular response—thirteen cases
   - (*a*) Four cases of alternating convergent strabismus
   - (*b*) Three cases of convergent strabismus with unilateral amblyopia
   - (*c*) Five cases of divergent strabismus with unilateral amblyopia
   - (*d*) One case of alternating divergent strabismus
2. Hypo-excitability of the vestibule—eighteen cases
   - (*a*) Four cases of alternating convergent strabismus
   - (*b*) Five cases of convergent strabismus with unilateral amblyopia
   - (*c*) Three cases of divergent strabismus with unilateral amblyopia
   - (*d*) Six cases of alternating divergent strabismus
3. Asymmetrically invoked nystagmus—none

(Cases have been reported in which the nature of the nystagmus changes.)

Jayle believes that hypo-excitability of the vestibule may indicate previous paralysis of the musculature.

L. L. MAYER. [ARCH. OPHTH.]

SECONDARY CHOLESTEATOMA: DEVELOPMENT, DESTRUCTIVE EFFECT, CLASSIFICATION AND INFUENCE ON PNEUMATIZATION OF THE MASTOID. M. MEYER, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **139**:127 (March 20) 1935.

Meyer reports the clinical history of a patient with cholesteatoma. On the basis of careful studies, he is convinced that in spite of a number of peculiarities the cholesteatoma was of the secondary type. A tumor of this type, in response to an irritation elicited by chronic otitis media or by otitis externa, usually originates in the internal portion of the auditory meatus and from there spreads into the middle ear; it may even proliferate into the massive bone. The connective tissue accompanying the downward growing cones of epidermis effects osteoclasis of the bone. This process is often accompanied by the splitting off of splinters or fragments which, surrounded by cones of epidermis and, in case of their destruction, by other necrotized local tissue elements, become localized in a small cholesteatoma bag, while adjoining bone portions remain outside. As a result of the necrosis of the epithelial dividing walls, several adjoining small cholesteatoma bags gradually merge into one large sac. In the reported case, the chronic mastoiditis which accompanied the cholesteatoma of the middle ear caused considerable formation of new bone, which resulted in secondary formation of spongiosa in the apical region. The old walls of the pneumatic spaces could be clearly differentiated from the newly formed spongiosa.

EDITOR'S ABSTRACT.

DETERMINATION OF THE UPPER LIMIT OF THE RANGE OF HEARING. DIDA DEDERDING, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **139**:174 (March 20) 1935.

It is pointed out by Dederding that the upper limit of the range of hearing is usually determined only as far as air conduction is concerned. It is the aim of this report to demonstrate that it must be determined also in regard to bone conduction and that only the comparison of the two values permits a definite diagnosis. The author made such double tests in 176 persons, 39 with normal hearing capacity and 137 with various aural defects. Tabular reports of the results are followed by an evaluating discussion.

EDITOR'S ABSTRACT.

CONTRIBUTIONS TO THE PATHOLOGIC ANATOMY OF THE EAR. H. RICHTER, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **139**:181 (March 20) 1935.

Richter gives the clinical history of a woman, aged 52, who died as the result of postoperative otogenic meningitis. The histologic aspects of the case are described in detail. On the right side there was chronic otitis media, and in the course of operative intervention luxation of the stapes took place. This resulted in diffuse purulent labyrinthitis and meningitis, followed by death. He points out that although operative luxation of the stapes is rare one must nevertheless be on guard against measures that might cause it. The patient also had bilateral otosclerosis with deformity of the stapes. On the left side the ankylosis of the stapes was still visible. On the right side the suppuration of the middle ear was accompanied by extensive formation of granulation tissue with penetration into the bone. Sections revealed that the granulations not only filled a large portion of the tympanum of the antrum and of the cells of the tympanic floor but penetrated up to the bulbus and caused considerable displacement of that. In view of the fact that no cholesteatoma could be found, the unlimited extension of the granulation tissue is surprising. The histologic aspects of the granulation tissue indicate that its formation preceded the operative intervention.

EDITOR'S ABSTRACT.

SUBLABYRINTHINE INFLAMMATION (SUPPURATION OF AQUAEDUCTUS COCHLEAE). H. KRAMM, Ztschr. f. Hals-, Nasen- u. Ohrenh. **37**:255 (May 18) 1935.

Kramm describes a histologically examined inflammation of the sublabyrinthine cells which led to suppuration and erosion of the aquaeductus chochleae and to meningitis. In discussing the surgical treatment in cases of this type, he points out that others in their surgical procedure followed the path of infection. How-

ever, since the cells that are closest to the tympanic cavity do not require treatment, because they heal spontaneously and because it is the involvement of the deeper labyrinthine cells and those that are in the median and posterior direction which causes complications, he decided to try to reach these cells directly by the posterior approach and to produce a counter-opening against the entry in the tympanic cavity. In the posterior approach, the direction of the pyramidal axis should be taken, whereas, if the operation is begun from the external auditory meatus, it leads (because of the course of the internal carotid) to the posterior wall. This is important in the advance toward the pyramidal apex. It might be assumed that in case of complete pneumatization of the mastoid process and of backward placement of the flat sinus there are always favorable conditions for the posterior approach. However, this is not the case. At any rate, it cannot be expected with certainty. A roentgenogram which reveals the presence of sublabyrinthine cells and their inflammation is an indispensable requirement. It is important that the distance between the roof of the auditory bulb and the lower limit of the bone of the labyrinth is sufficient, and if the bulb is rather flat it is possible to approach the cells from the posterior direction. Occasionally the cells which are underneath the labyrinth and the internal auditory meatus and which reach into the pyramidal apex can be attained without difficulty. However, these favorable conditions are rare. After the exposure of the posterior semicircular canal, the surgeon usually reaches a hard bony plate which extends from the posterior semicircular canal and between the inferior surface of the labyrinth, the inner table of the posterior cranial fossa and the roof of the bulb. This bony plate separates the cells of the mastoid process completely from the sublabyrinthine ones. Kramm thinks that if these two cell complexes were not separated in this manner, sublabyrinthine inflammations would be more frequent in cases of inflammation of the mastoid. It is inadvisable to perforate this plate unless there is certainty of a severe inflammation of the sublabyrinthine cells. However, if opening the plate is necessary, it should be removed with the chisel as far as possible, after which the removal of the pathologic tissues can proceed. He considers this posterior exposure of the sublabyrinthine cells superior to their exposure from the middle ear.

EDITOR'S ABSTRACT.

NERVES AND GANGLIONS OF THE TYMPANIC CAVITY IN RATS AND GUINEA-PIGS. S. ERNYEI and P. BACSICH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **37**:276 (May 18) 1935.

Ernyei and Bacşich examined the nerves and ganglions of the tympanic cavity of the guinea-pig and of the white rat according to the newest histologic methods. After the animals had been killed, the freshly obtained organs were fixed (according to Wittmaack and de Castro), decalcified and doubly embedded (pyroxylin [celloidin]-paraffin after Apáthy and Bacsich). Serial transverse as well as longitudinal sections were made, some of which were treated with the prolonged osmium process (according to F. Kiss), others with silver stains (according to Ramón y Cajal and de Castro) or with gold chloride (according to Lenhossék, 1895). The observations which the authors made on these preparations are summarized as follows: 1. The trunk and the branches of the trigeminal nerve contain fibers with thick as well as fibers with thin medullary sheaths. Nonmedullated fibers are found only in negligible number in the marginal portions of the mandibular nerve. The ganglion of the trigeminal nerve (the semilunar ganglion) consists of two types of cells: light ones (sensory) and dark ones (sympathetic). 2. In the facial nerve only medullated fibers can be found. The intermedius nerve consists mostly of medullated fibers and only in a minor portion of nonmedullated fibers. The chorda tympani is free from nonmedullated fibers; the majority of its fibers have thin medullary sheaths and only a few have thick medullary sheaths. The geniculate ganglion has light and dark cells. These ganglion cells may also be dispersed in the large superficial petrosal nerve. 3. The glossopharyngeal nerve has mostly medullated and only a few nonmedullated fibers. In the tympanic nerve there are nonmedullated fibers and fibers with thin and with thick medullary sheaths. In

the largest nerve bundles of the tympanic plexus there are more medullated than nonmedullated fibers; however, in the smaller bundles the nonmedullated fibers predominate. The small superficial petrosal nerve contains nonmedullated fibers as well as fibers with thin medullary sheaths. In the jugular and petrosal ganglion, two types of cells can be differentiated: light ones and dark ones. In the tympanic nerve, small groups of ganglion cells, likewise with light and dark cells, can be distinguished underneath the mucous membrane of the tympanic cavity.

EDITOR'S ABSTRACT.

SPEECH DISTURBANCES IN CASES OF OTOGENIC CEREBELLAR ABSCESS. T. GORDYSCHEVSKI, Ztschr. f. Hals-, Nasen- u. Ohrenh. **37**:*292* (May 18) 1935.

Gordyschevski relates the clinical history of a patient with a large cerebellar abscess that developed after acute purulent otitis media. The patient had the typical disturbances of coordination of the extremities and a scanning speech. Such speech disorders in cases of cerebellar abscess, although known, have been described only rarely. Gordyschevski thinks that otologists have given too little attention to them. He emphasizes that the appearance of dysarthria in a patient suspected of having an intracranial complication of otogenic origin indicates a cerebellar abscess. Although dysarthria is comparatively rare in association with cerebellar abscess, and although it generally occurs with other typical disturbances of coordination, he cites an instance in the literature which demonstrates that there are cases in which dysarthria is practically the only focal symptom. For this reason it is advisable to watch for the symptom.

EDITOR'S ABSTRACT.

Pharynx

THE OCCURRENCE OF THE STREPTOCOCCUS HEMOLYTICUS IN THE THROAT OF CHILDREN ON HOSPITAL WARDS. LEO B. BURGIN and HAROLD L. HIGGINS, J. Pediat. **5**:156 (Aug.) 1934.

To detect the presence of hemolytic streptococci, cultures were taken from the throats of nurses and patients in the children's ward of the Massachusetts Eye and Ear Infirmary weekly for twenty-seven consecutive weeks. There was a great variation in the weekly incidence of carriers, the peak occurring approximately every month. The carrier rate was higher in children with tonsils than among those without tonsils. The general carrier rate among all the children was 43.8 per cent and was no higher in the rooms with patients who had mastoditis than in the rooms with patients who had noninfectious diseases of the eye.

LEMASTER, Evanston, Ill. [AM. J. DIS. CHILD.]

TONSILLECTOMY WITH LOCAL ANESTHESIA: A REVIEW BASED ON 500 CASES. GEOFFREY MOREY, Brit. M. J. **2**:990 (Dec. 1) 1934.

Morey pleads for a more extensive use of local anesthesia in performing tonsillectomy. "The advantages of using a local anesthestic are that the operation is considerably more speedy without there being any sacrifice of efficiency; that there is a minimum amount of bleeding (often there is literally none at all); that there is no vomiting; and that there is a cleaner dissection. The patient suffers no pain and extremely little discomfort."

ROYSTER, University, Va. [AM. J. DIS. CHILD.]

TREATMENT OF ADENOID SEPTICEMIAS BY CRUSHING THE VEGETATIONS WITH THE FINGER. ROBERT RENDU, Arch. de méd. d. enf. **38**:83 (Feb.) 1935.

Rendu distinguishes two forms of infection originating in adenoid tissue, the first being the typical acute adenoiditis of from four to eight days' duration and

the other a more prolonged invasion, continuing often for several weeks, characterized by wide oscillations of temperature and pronounced reaction in the cervical lymph nodes.

The latter was brought to the attention of physicians in 1926 by Rendu, whose treatment by digital ablation has been accepted by French otolaryngologists as practically specific. On the basis of the assumption that the symptoms are a reflection of the absorption of toxic products retained between the inflamed lamellae of the adenoid vegetations, the clinician is advised to crush these growths with the finger thoroughly. In many instances the relief is almost immediate: The fever subsides; the glandular involvement disappears, and the patient promptly progresses to normal health. Gamaleia and Michon have coined the term "providential finger" in reporting several dramatic instances of relief in obstinate cases, while many other observers have given this simple expedient their frank approval.

AMESSE, Denver. [AM. J. DIS. CHILD.]

CHRONIC TONSILLITIS. W. SCHÜTZ, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **139:** 198 (March 20) 1935.

Schütz points out that the clinical connection of recurrent tonsillitis with articular, renal and cardiac disturbances led to a search for the morphologic forms of chronic tonsillitis. After mentioning other authors who have investigated this problem, he reports histologic studies of the palatine tonsils obtained by operation from patients with chronic tonsillitis. He differentiates two types of tonsillitis: the chronic hypertrophic form and the chronic atrophic form. He concedes that a strict differentiation between these is not always possible, for there are transitional forms. In comparing the histologic with the clinical aspects he found that in chronic hypertrophic tonsillitis the tendency toward complications is considerably less than in the chronic atrophic form. In elucidating his conception of complications he points out that the clinical aspects of chronic tonsillitis are determined by the always existing suppuration of the palatine tonsils, which at certain intervals flares up in acute inflammation. Complications may be of two types: On the one hand, the continuous spreading may result in chronic peritonsillitis or in peritonsillar abscess; on the other hand, the inflammatory complication may spread by way of the lymph or blood channels. Schütz disregards the severest forms of the metastatic type of complication, such as sepsis, thrombosis of the jugular vein, abscesses of the cervical lymph nodes and so on, and gives his attention only to articular and muscular rheumatism, cardiac defects and renal disease, in which a blood-borne infection must be assumed. It is a well known fact that severely fissured small tonsils cause peritonsillar abscess and articular rheumatism more often than do other kinds. The author's observations reaffirm this fact. Of 100 pairs of tonsils examined, 68 were of the chronic hypertrophic type and 32 of the chronic atrophic type. Of the patients with hypertrophic tonsils, 45.6 per cent presented complications; of those with atrophic tonsils, 72 per cent. Schütz points out further that in the majority of patients with chronically hypertrophic palatine tonsils the pharyngeal tonsils are likewise enlarged, whereas in patients with chronically atrophic tonsils there are usually no pharyngeal tonsils. He thinks that the age and the constitution of the patient are likewise decisive in the development of atrophic or hypertrophic tonsillitis. The hypertrophic form usually predominates in younger patients; the atrophic one, in older patients. The author shows that this knowledge is helpful in the treatment of chronic tonsillitis.

EDITOR'S ABSTRACT.

SCARLET FEVER FOLLOWING TONSILLECTOMY. R. MITTERMAIER, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **26:**134 (June) 1935.

Mittermaier reports that in the years between 1930 and 1934 he observed ten children in whom scarlet fever developed following tonsillectomy. Three of the cases of scarlet fever occurred close together so that a transmission seems possible;

three other cases occurred at a time when the disease was rather prevelant, and it is possible that in these cases tonsillectomy was performed during the period of incubation. The other cases, however, occurred at long intervals. The scarlatina always appeared on the second or third day after the tonsillectomy with sudden febrile temperatures and with a more or less pronounced exanthem. The hemogram always disclosed leukocytosis and also eosinophilia. The urobilinogen test was positive, as was also the blanching phenomenon. The fever and exanthem disappeared within a few days, and the desquamation took the usual course. There were no complications involving the kidneys or other organs except that in one case there developed swellings and suppurations of the cervical glands, the pus containing hemolytic streptococci. The author evaluates three etiologic theories of scarlatina, namely, the theory that it is caused by a special pathogenic microorganism, the theory that hemolytic streptococci cause it, and the opinion that an unknown virus, which supposedly is closely connected with hemolytic streptococci, is the causal factor. In any event, it is likely that chronically infected tonsils are the foci of infection. The author further discusses whether there is a difference between the ordinary epidemic scarlatina and the so-called wound scarlatina. He is convinced that the latter is a true scarlatina, for it presents all the aspects of scarlatina. Then he evaluates the rôle played by the tonsils in the causation and course of scarlatina and reaches the conclusion that it has not been definitely explained as yet. He thinks that postoperative scarlatina might be more frequent than is generally assumed and hopes that his report will induce others to watch the incidence of this form of scarlatina. He suggests that they observe whether the disease always takes a comparatively mild course as in the cases observed by him.

EDITOR'S ABSTRACT.

Larynx

PAPILLOMATA OF THE LARYNX WITH CASE REPORTS. B. F. GLOWACKI, J. Michigan M. Soc. **33**:564 (Oct.) 1934.

Glowacki reports the case of two children with papillomas of the larynx. Both children made satisfactory progress after tracheotomy, and attention was given to building up their general condition.

The author believes that no value accrued through the use of magnesium oxide, the direct application of radium or electrocoagulation; he thinks that severe edema, perichondritis and necrosis have followed their use.

CAREY, Detroit, Mich. [AM. J. DIS. CHILD.]

AN UNUSUAL LARYNGEAL FOREIGN BODY. F. HOLT DIGGLE, Brit. M. J. **2**:771 (Oct. 27) 1934.

A foreign body in the laryngoscope was the eye component of a hook and eye. This object straddled the left vocal cord and was removed without difficulty.

ROYSTER, University, Va. [AM. J. DIS. CHILD.]

OBSTRUCTIVE PANLARYNGITIS. MARTÍNEZ VARGAS, Med. de los niños **35**:387 (Dec.) 1934.

A case of obstructive laryngitis is reported in a child aged 2½ years. The epiglottis became adherent to the laryngeal vestibule, and an inflammatory mass occluded the subglottic space; the condition was described as obstructive panlaryngitis. The dangers of the production of adhesions by the tracheal cannula is discussed, as well as obstructive lesions such as congenital membranous cicatrices, cartilaginous occlusions, perichondritis and laryngeal stricture.

DWYER, Kansas City, Mo. [AM. J. DIS. CHILD.]

SOUND PLATE REGISTRATION OF VOICE DISTURBANCES DURING PUBERAL CHANGE OF VOICE. R. SCHILLING, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **26**:90 (June) 1935.

Schilling states that the otorhinolaryngologic clinic of the University of Freiburg, Germany, has established a sound plate archive. Thus the clinic has acoustic illustrations of the case histories, and repeated overhearing of the voice discloses aspects that otherwise may not be detected. He recently made sound records of the voices of two youths during the puberal change of the voice. He discusses the peculiarities of these two voices, which he recorded during counting, reading and the singing of the scales and of a song. He describes also the physical aspects of these youths and reaches the conclusion that the disturbances developing during the puberal change of the voice (mutation) in these two youths were of two distinct types: In the one the disturbance was caused by hormonal changes; in the other it was not. He characterizes the mutation disturbances that are caused by hormonal disorders as follows: The mutation takes place almost unnoticed and results in only slight lowering of the voice. The range of the voice changes only little as compared with that of the child and corresponds somewhat to that of the voice of the adult woman. There are no breaks at the points of transition between the registers. The pitch of the speaking voice is considerably higher than that of the normal male voice, however; in the total range of the voice it is nearer to the lower limits. Schilling asserts that the mutation disturbances caused by hormonal disorders are comparatively rare. In the case reported here, the hormonal character was indicated by several physical characteristics that indicated hypofunction of the gonads and hyperfunction of the anterior lobe of the hypophysis. The mutation disturbances that are not of hormone origin are much more frequent. In the older literature this type, too, is referred to as a eunuchoid disturbance, but this is wrong, and the term "eunuchoid" should be reserved for those disturbances that are of hormone origin. The second form is now frequently referred to as "persisting falsetto voice." Whereas in the eunuchoid form the speaking as well as the singing voice is affected, in the persisting falsetto voice frequently only one of the two is involved—in the reported case, only the singing voice. The voice range corresponds to that of the male voice but frequently seems reduced to the upper portion whereas in reality the lower portion is present but is functionally excluded, for this disturbance is the result of a disproportion in the functions of the different muscles. The voice disturbance that is the result of hormonal changes is hardly at all amenable to treatment, but the other type frequently can be corrected by simple manipulation and subsequent exercises.

EDITOR'S ABSTRACT.

Nose

A NEW CLINICAL FORM OF THE SYNDROME OF THE NASAL NERVE. J. M. V. ORTIZ, Ann. d'ocul. **171**:479 (June) 1934.

Ortiz reports the following case: Marie X., aged 27, an Argentine, married, with a family history of no importance, at the beginning of the year complained that for several days she had had violent orbital and periorbital attacks of pain on the left side, which were especially localized on a level with the palpebral-frontal region and sometimes radiated toward the ala of the nose and toward the temporoparietal region on the same side. At times these attacks were so violent that the patient was unable to sleep. They were accompanied by photophobia, excessive epiphora and a painful pricking sensation on a level with the eye on the same side. At that time the conjunctiva was congested, but no secretion was present. There was excessive nasal secretion on the same side as the neuralgic pain. Treatment confirmed the tentative diagnosis of syndrome of the nasal nerve, because following the application of pulverized cocaine and epinephrine to the anterior part of the left nasal cavity all the symptoms disappeared.

Ortiz states that this is the first case reported in which a nasal syndrome was present with a lesion of the conjunctiva without conjunctivitis and without a lesion of the cornea or the iris. Although this new clinical form has not been studied, it has been observed by Charlin. In the majority of cases this syndrome is caused by an irritated nasal spur. In the present case the rhinologist confirmed the fact that there was a deviation of the nasal septum, but Ortiz states that the etiologic factor may be of general origin. Charlin has described interesting cases in which syphilis, diabetes and a buccodental focus of infection were the determining causes of the syndrome of the nasal nerve.

Before applying cocaine and epinephrine it is necessary to make a thorough clinical examination in order to ascertain the general cause of neuritis of the nasal nerve.

BERENS, New York. [ARCH. NEUROL. & PSYCHIAT.]

FRONTO-ETHMOIDAL SINUSITIS EXTERIORIZED. J. BOURGUET and E. HAAS, Bull. Soc. d'opht. de Paris, February 1935, p. 107.

Bourguet and Haas contribute a photograph of a 72 year old woman showing swelling of the lids before operation and another showing the results after operation. There was an absence of chemosis, exophthalmos or any interference in ocular motion. The pain was intense and diffuse. Roentgenograms showed haziness of the frontal and ethmoid sinuses. The operation is described. The authors call attention to the fact that many of the so-called cases of orbital osteoperiostitis are in reality cases of exteriorized sinusitis. In spite of the more or less benign local and general symptoms, roentgenograms reveal the extent of the lesion, which is best relieved by radical procedures.

L. L. MAYER. [ARCH. OPHTH.]

EFFECT OF CLOSURE OF A NOSTRIL ON THE OLFACTORY MUCOUS MEMBRANE AND ON THE BULBUS AND TRACTUS OLFACTORIUS. V. FRÜHWALD, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **139**:153 (March 20) 1935.

Frühwald says that he was induced to conduct the studies described here by a report which Brunner published more than a decade ago. Brunner called attention to extensive degeneration in the bulbus olfactorius traceable to degenerative changes in the olfactory mucous membrane. Subsequently, other observers described degenerative changes in the olfactory mucous membrane. However, the causal factors are not entirely clarified yet. Frühwald considers the most important causal factors to be inflammatory changes of the nasal mucous membrane and obstructions in the air passages of the nose. In order to determine in what manner obstructions of nasal air passages influence the structure of the olfactory mucous membrane, he made experiments on rabbits. He found that unilateral exclusion of nasal respiration leads in young animals to simple reduction of the olfactory mucous membrane and in adult animals to degenerative changes. In both cases the atrophy can be traced from the olfactory mucous membrane all the way to the bulbus, where it usually ceases at the end of the first neuron. Corresponding lateral nasal obstruction may be the result of a deviation of the septum, of hypertrophy of the conchae or of other causes. On the basis of the reported experiments, more or less severe degenerative changes in the olfactory mucous membrane must be counted on in patients who present such conditions. The changes may be expected to be the more severe the longer the obstruction has persisted. That this is so is proved by the fact that in many of the cases the olfactory sense does not return after the nasal obstruction has been removed.

EDITOR'S ABSTRACT.

DEATH DURING PUNCTURE OF THE ANTRUM: FORENSIC CASE. E. BRUCH, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **28**:65 (June) 1935.

A man, aged 56, became indisposed and finally collapsed during puncture of the antrum by Bruch and died eighteen hours later. This death involved Bruch

in a lawsuit in which he was charged with "manslaughter through negligence." For anesthetization he had used a 10 per cent solution of cocaine, which he administered by introducing the usual cotton tampons into the lower nasal ducts on both sides. In the course of the legal procedure expert testimonies were rendered by a rhinologist, a pathologic anatomist and a pharmacologist. Bruch gives brief summaries of these testimonies and states that the final decision was that the death of the patient might have been caused by hypersensitivity of the patient's nose to the solution of cocaine or by cerebral air embolism. It was decided that for the latter possibility the defendant could not be held accountable, and for the results of the hypersensitivity of the nose, only under certain conditions. He was freed from the charge of "manslaughter through negligence." He states that especial attention was given to the problem of air embolism and points out that it is almost impossible to render a syringe, tube and needle entirely free from air and that the air which is present in the maxillary sinus can never be eliminated. In this connection he also calls attention to a mechanisim of air embolism that hitherto has not been given consideration but which it seems may have occurred in this case, namely, the regurgitation of air from the punctured maxillary sinus into veins of the bone in the median wall of the sinus or into veins of the nasal mucous membrane. In the case under consideration the puncture had been made (because of certain conditions) far anteriorly through relatively thick bone, and there was considerable venous bleeding, probably from the venous plexus in the region of the opening of the lacrimal duct in the lower nasal passage.

EDITOR'S ABSTRACT.

Miscellaneous

RELATIONSHIP BETWEEN AGRANULOCYTOSIS AND INFECTIOUS MONONUCLEOSIS. T. SKOOG, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **139**:189 (March 20) 1935.

Skoog compares agranulocytosis and infectious mononucleosis and points out that attempts have been made to detect connections between them. Those who have tried to link the two conditions have given special attention to the so-called transitional conditions. However, Skoog shows that there are a number of factors which indicate that the two diseases are different. After mentioning the differences in prognosis between them, he considers the differences in etiology, giving especial attention to the rôle of chemical substances, particularly to that of aminopyrine, in the pathogenesis of agranulocytosis and points out that in the pathogenesis of infectious mononucleosis such a factor has never been detected. Further he discusses the differences in the blood picture, which indicate that the pathogenic points of attack in the two conditions are different. After calling attention to differences in clinical manifestations and in treatment, he reaches the conclusion that in view of all these differences little remains of the hypothesis of a relationship. Then he takes up the problem of the so-called transitional conditions and shows that the outcome of Bunnel's reaction demonstrates that the two conditions are different. He concludes that thus a further support has been withdrawn from the theory that assumes a connection between agranulocytosis and infectious mononucleosis.

EDITOR'S ABSTRACT.

FAULT OF SPECIALIST IN FAILURE TO RECOGNIZE MALIGNANT TUMORS OF THE UPPER AIR AND FOOD PASSAGES. H. LEICHER, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **26**:68 (June) 1935.

Who is responsible if a malignant tumor is not recognized early enough? Leicher points out that occasionally it is the patient who fails to seek medical aid early enough, that on other occasions it is the general practitioner who does not refer the patient promptly enough to a specialist, but that in a considerable number of cases it is the specialist who fails to recognize the condition at once. He analyzes fifty-eight cases of malignant tumors of the upper air and food passages

with regard to the promptness of the diagnosis. A table shows the number of weeks lost through (1) the fault of the patient in not consulting a physician immediately after the appearance of the symptoms, (2) the fault of the practitioner and (3) the fault of the specialist. He gives especial attention to the column in which the negligence of the specialist is indicated. He shows that sixteen patients with internal laryngeal cancers were under the care of specialists for an average of four weeks before the malignant growths were recognized. To be sure, in seven of these cases the correct diagnosis was made in the course of the first or of the second examination, but this implies that in the remaining nine cases the time that elapsed before a correct diagnosis was reached was considerably more than four weeks. He enumerates the various examinations that are absolutely necessary. He mentions exposure of the anterior commissure of the larynx if necessary with the aid of Reichert's hook or by elevation of the anesthetized epiglottis. Since the tumor must be not only seen but examined histologically laryngofissure may be required, for an exploratory excision by means of a curet may fail. Leicher describes the observations he made in four cases in which he resorted to laryngofissure in the course of the last year. The report of one of these four cases indicates plainly that laryngofissure may prevent not only an erroneous diagnosis but also a too radical intervention. In this case a total extirpation of the larynx was prevented. Leicher deplores that in cases in which a tumor of the hypopharynx is suspected the hypopharyngoscopy of von Eicken or Brüggemann is not employed often enough. He does not discuss all the different types of tumors that are mentioned in the table of fifty-eight cases, but he emphasizes that the most important factor in the early diagnosis of a malignant tumor is the thought of the possibility of such a tumor, for the failure to think of it, not ignorance of the proper methods of examination, is the chief factor in the erroneous diagnosis. He mentions the cases of a youth, aged 17, and a woman, aged 21, in whom the cancers were recognized only in advanced stages because, in view of the youth of the patients, cancer had not been thought of. A case of esophageal cancer had not been recognized because the difficulties in swallowing and in speech had been ascribed to an existing struma. The author concedes that the serologic tests for the diagnosis of cancer may eventually facilitate early diagnosis of cancer, but he also emphasizes that not too much should be expected of these tests.

EDITOR'S ABSTRACT.

GAS PHLEGMON ORIGINATING IN ORAL INFECTION. K. GRAHE, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **26**:81 (June) 1935.

Grahe reports the clinical histories of two patients who had infections that originated one in the tonsils and one in the teeth. In both cases a sanious suppuration with gas formation developed which progressed rapidly and led to extensive necrosis of the connective tissues so that fistulas developed from the mouth outward, also parotic fistulas and arrosions of blood vessels. The arrosions caused severe hemorrhages which threatened life. The muscles were not attacked by the necrosis. In treating these conditions Grahe resorted to wide incision, irrigation of the pockets and fistulas, tamponades with serum of gas edema, intravenous injection of this serum, blood transfusions, removal of the foci of infection and administration of circulatory remedies. The patients recovered. He points out that the fact that the muscles were not attacked by the infection indicates that the infection was not gas gangrene but gas phlegmon. To be sure, the demarcation is not sharp, and there is no general agreement regarding either the clinical or the bacteriologic aspects of the two. The Welch-Fraenkel bacillus is usually considered as the chief cause of the rapid destruction of the musculature. However, this organism apparently undergoes changes if the nutrient medium changes. Moreover, the formation of gas may be caused by a number of other micro-organisms. In the cases reported here, the Welch-Fraenkel bacillus could not be detected, but there were streptococci with partly anaerobic growth. The destruction of the connective tissue was such that the muscles and bones were entirely naked. Of especial clinical importance was the arrosion of larger vessels.

The patients were saved because a physician was present to take the necessary steps to control the severe hemorrhage and administer blood transfusions. The serum of gas edema proved unusually effective. Following its local application the fetor and the destruction of the tissues ceased at once. EDITOR'S ABSTRACT.

EXPERIENCES WITH MAGNIFYING SPECTACLES IN OTOLARYNGOLOGIC OPERATIONS. O. MAYER, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **26**:86 (June) 1935.

Mayer describes experiences with an apparatus for the optical enlargement of the operative field. It consists in a combination of the magnifying spectacles of Zeiss, which Nordenson recommended as early as 1923, with an electrical head reflector, 5 cm. in diameter. The electrical head reflector is fastened by means of a headband and a double joint in such a manner that it stands at the root of the nose between the two magnifying glasses. The apparatus makes it possible to see objects at a distance of 25 cm. in twofold magnification and under good illumination. Mayer asserts that this illumination and magnification considerably facilitate the various surgical manipulations. EDITOR'S ABSTRACT.

SOME RARE FORMS OF ALLERGY. C. R. GRIEBEL, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **26**:99 (June) 1935.

Griebel gives several interesting case reports of unusual forms of allergy. Chronic eczema and attacks of asthma in a barber were finally discovered to be caused by the soap he used. Attacks of sneezing in a butcher were caused by contact with mutton. Asthma in a cabinet-maker was found to be elicited by a corrosive fluid which he used. Attacks of sneezing and difficulties in breathing in a rubber goods merchant were caused by benzol (benzene), which plays an important part in the fabrication of rubber. Attacks of sneezing as well as itching and burning of the lips in a woman were found to be caused by a type of wood out of which the new mouthpiece of her flute was made. In a chemist, swellings and itching were found to be elicited by hydrogen selenide, with which he had worked for some time. The author agrees with Doerr, who maintains that a hereditary anlage plays a part in the development of these idiosyncrasies.

EDITOR'S ABSTRACT.

EXPERIENCES WITH SPLEEN EXTRACT IN THE TREATMENT OF ALLERGIC DISEASES. C. R. GRIEBEL, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **26**:105 (June) 1935.

Griebel observed on experimentally sensitized animals that the disturbances produced were favorably influenced by spleen extract. The eosinophilia was frequently reduced to normal values. This induced him to resort to spleen therapy in the treatment of disorders in which eosinophilia exists, namely, allergic diseases. He obtained satisfactory results in uncomplicated vasomotor rhinitis in cases in which severe attacks of sneezing and of profuse discharge of mucus were not associated with any detectable foci of infection in the accessory nasal sinuses. With the onset of the treatment with spleen extract, which was given at once in rather large doses (up to 2 cc. subcutaneously), the attacks of sneezing became milder, the head felt freer, and the discharge of mucus decreased. The usually existing eosinophilia often receded to normal values. In these cases it could be seen that a reduction in the number of eosinophils was accompanied by improvement in the disorder. In chronic cases of hay fever and of bronchial asthma in which a causal allergen could be detected but in which there existed no eosinophilia it was possible to produce by means of subcutaneous injections of spleen extract an increase in the number of eosinophils and frequently also a reduction in the symptoms. The author concludes from this that the spleen extract exerts a regulating influence on the eosinophilopoiesis in the bone marrow. EDITOR'S ABSTRACT.

CLINICAL EXPERIENCES WITH FRACTURES OF THE CRANIAL BASE. E. WIRTH, Ztschr. f. Laryng., Rhin., Otol. (Teil 1: Folia oto-laryng.) **26**:109 (June) 1935.

Although twenty-five years ago Voss advised operative procedures for fractures of the cranial base passing through the ear and the accessory sinuses, in more recent years he has relied less on extensive surgical intervention and has been satisfied more often with an expectant attitude. Wirth says that the expectant attitude in the treatment of fractures of the base of the skull has prevailed at the otorhinolaryngologic clinic of the University of Heidelberg. In order to find whether in some cases it might not have been advisable to resort to a more active treatment, he analyzes the data on fractures of the base of the cranium with involvement of the ears and the accessory cavities which have been treated at that clinic during the last ten years. He reaches the conclusion that there is no cause to change from an expectant attitude. In cases without demonstrable infection he considers an expectant attitude far better than a prophylactic operation. To be sure, it is absolutely necessary to keep the condition of the nose and ears under careful observation. With Voss, he advises that the treatment of cranial fractures with involvement of the nose and ears should be entrusted to the otorhinologist. He thinks that patients with such fractures should, if possible, be referred at once to an otologic clinic, for in the surgical departments the injuries of the nose and ear are frequently not given the attention which they deserve.

EDITOR'S ABSTRACT.

Book Reviews

Les hydrocéphalies, aiguës et subaig uës d'origine otique. Accidents méningés otogènes purement hypertensifs. By Robert Bourgeois, Senior Intern, Lauréat, Hospital of Paris. Paper. Price, 32 francs. Pp. 178, with a bibliography. Paris: Masson & Cie, 1935.

Bourgeois describes certain complications of otic origin, characterized by intracranial hypertension and practically always accompanied by pupillary stasis. He pictures this condition as cerebromeningeal edema, due to an accumulation of cerebrospinal fluid, normal or altered, under pressure, and amenable to relief by therapeutic or surgical evacuation. He does not contend that a pathologic condition of the ear is the sole cause of this type of intracranial disorder but calls attention to other factors, such as concurrent infection, toxic irritation, traumatism and reflex excitation. However, he believes that this intracranial hypertension of otic origin is equally spectacular. Considering the condition from the point of view of an otologist, he maintains that the therapeutic and surgical attack in these complications of otic nature should be initiated from the vicinity of the ear. He describes three forms of this type of hydrocephalus: (1) superficial and diffuse edema of the meninges; (2) a deep-seated condition involving the cerebrospinal fluid and evidenced principally in the ventricular spaces; (3) a disorder resulting in an abscess, cyst or pseudocyst and localized in the posterior fossa.

This monograph is complete. Bourgeois treats the subject in outline form, furnishing detailed reports of cases taken not only from his own experience but also from the literature. An extensive bibliography is appended.

Luftwege, Mund und Ohr. Diagnostik in Tabellenform. By Dr. Alexander Cemach, Facharzt für Hals-, Nasen- und Ohrenkrankheiten in Wien. Price, 20 marks. Pp. 132, with 370 illustrations and 38 tables. Vienna: Wilhelm Maudrich, 1936.

This is a valuable clinical textbook in two parts. The first part includes chapters on the fundamentals and on diagnosis and examination. The second, or special, part consists of 38 tables in which the various diseases are classified and diagrams are given concerning the clinical facts and the differential diagnosis. Both parts are profusely illustrated; altogether, there are 370 illustrations, for the most part in color.

Directory of Otolaryngologic Societies *

FOREIGN

Collegium Oto-Rhino-Laryngologicum Amicitiæ Sacrum

President: Prof. Gunnar Holmgren, Karolinska Mediko Kirurgiska Institut, Stockholm, Sweden.
Secretary: Prof. Dr. C. E. Benjamins, Verlengde Heereweg, 143 Groningen, The Netherlands.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Ralph A. Fenton, 1020 S. W. Taylor St., Portland, Ore.
Secretary: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.
Place: Kansas City, Mo. Time: May 11-15, 1936.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Wells P. Eagleton, 15 Lombardy St., Newark, N. J.
President-Elect: Dr. Frank E. Burch, 408 Peter St., St. Paul.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: New York. Time: Sept. 26-Oct. 3, 1936.

American Bronchoscopic Society

President: Dr. H. M. Taylor, 111 W. Adams St, Jacksonville, Florida.
Secretary: Dr. Lyman Richards, 319 Longwood Ave., Boston.
Place: Detroit. Time: May 27, 1936.

American Laryngological Association

President: Dr. Burt R. Shurly, 62 W. Adams Ave., Detroit.
Secretary: Dr. James A. Babbitt, 1912 Spruce St., Philadelphia.
Place: Detroit. Time: May 25-27, 1936.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Thomas E. Carmody, Metropolitan Bldg., Denver.
Secretary: Dr. R. L. Loughran, Sharon, Conn.
Place: Brown Palace Hotel, Denver. Time: May 18-20, 1936.

SECTIONS:

Eastern.—Chairman: Dr. Henry B. Orton, 24 Commerce St., Newark, N. J.
Southern.—Chairman: Dr. Robin Harris, Lamar Bldg., Jackson, Miss.
Middle.—Chairman: Dr. W. E. Grove, 324 E. Wisconsin Ave., Milwaukee, Wis.
Mid-Western.—Chairman: Dr. Harry W. Lyman, Carleton Bldg., St. Louis.
Western.—Chairman: Dr. Carroll Smith, Paulsen Bldg., Spokane, Wash.

American Otological Society

President: Dr. Francis R. Packard, 304 S. 19th St., Philadelphia.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.
Place: Detroit. Time: May 28 and 29, 1936.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.